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A. L. I. WINNE.

The chairman of the House of Delegates is a native of Virginia and a graduate of the School of Pharmacy of the Medical College of Virginia. He has taken an important part in the work of the Virginia Pharmaceutical Association, Boards of Pharmacy and the AMERICAN PHARMACEUTICAL ASSOCIATION for many years.

Mr. Winne has been the secretary of the Virginia Board of Pharmacy since 1919 and is largely responsible for the splendid record this board has made in its work as a registering agency and in its enforcement of the laws entrusted to it.

In the Virginia Pharmaceutical Association, he has served as secretary since 1920, as treasurer since 1927, as editor of the Virginia Pharmacist, the official publication of the Association, since 1919 and as its delegate on many occasions.

His connection with the Virginia Board of Pharmacy brought Mr. Winne into the National Association Boards of Pharmacy where he has served on important Committees and as the president in 1931–1932.

Since 1919 Mr. Winne has been an active member of the AMERICAN PHARMACEUTICAL ASSOCIATION and has served it in many important capacities including the first vice-president in 1929–1930. Space permits reference to only two of his valuable contributions. As the first chairman of the Committee on Pharmacy Corps in the U. S. Army he directed a campaign which finally brought commissions to pharmacists in this branch of the United States service. In 1927 he was instrumental in organizing the Conference of Pharmaceutical Association Secretaries and was the first president of this group, which has served a very useful purpose in bringing these key officers of state and local associations into a strong working organization.

Chairman Winne is deeply interested in the House of Delegates and at the New York meeting opened a discussion on "Making More Effective the Affiliation between the A. PH. A. and the State Pharmaceutical Associations." His election as chairman of the House is another well-deserved recognition of his services to Pharmacy.

EDITORIAL

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THE LABORATORY OF THE AMERICAN PHARMACEUTICAL ASSOCIATION.

THE ANNOUNCED intention of the AMERICAN PHARMACEUTICAL ASSOCIATION to proceed with the establishment of a laboratory for drug standardization is one more step toward the complete realization of the dreams of its leaders, from the founders to those who planned and erected the Headquarters Building. The announcement comes at a most opportune time, for we are approaching ever closer to the date when active revision work must begin in preparation for the next editions of the National Formulary and the United States Pharmacopœia.

Both of these volumes have based their whole existence too long upon the entirely gratuitous services of the elected members of the revision committees and their many voluntary associates. To give up these voluntary services in their entirety is unthinkable, for the reason that one of the strongest features of these compendiums is their independence, which is secured only by the democratic methods by which the revision committees are constituted and work. Nevertheless an increased centralization of the laboratory control of revision seems well indicated. Neither volume is dominated either by enforcement official, producer or consumer, but a consistent effort has been made and is being maintained to serve the actual needs of all groups with an equal degree of fairness.

The first sixty years of the Pharmacopœia's life found it little more than a materia medica and formulary; the last sixty have seen it grow into a most comprehensive handbook of standards for all phases of the practice of medicine and pharmacy. The National Formulary has not undergone so complete a transformation in scope as the Pharmacopœia, but its precision as a volume of standards has increased in practically the same degree. The completeness of these books has only been possible through the great development in laboratory procedure during the past half-century. Scientific progress has not only been so great but comes so rapidly that it is a constant effort for even the continuous worker in the laboratory to keep abreast of what is taking place.

The admission of a new title, or the introduction of a new test, is a matter of weeks, months or even years of work in the laboratory. Though all of the procedures that appear in the monograph may have been taken from the published literature it is rare that the test has been compared by many operators or that the findings have been subjected to the critical scrutiny of court procedure. There have been only two agencies to date that have had the interest in these monographs that might lead to their critical study; the regulatory officials who enforce the standards, and the manufacturers' laboratories who must see that their products conform thereto. The former agency is usually so bogged down by a combination of a press of work and an inadequate staff hampered by miserly appropriations that they are prone to accept without question the texts of the official volume. Therefore, it has been necessary to rely very largely upon manufacturers' laboratories for critical study of the several monographs.

Various axegrinders have seen fit to utter public criticism of both the U. S. P.

and the N. F. on the ground that they are dominated by industry. This is utterly without foundation for two reasons. *First*, an examination of the personnel of the revision committees shows a great preponderance of representatives of the non-industrial groups. *Secondly*, those who have been engaged for years in revision work will testify that the contributions from the industrialists of pharmacy have been only of the nature of helpful and constructive suggestions and criticism. Rather than criticize these standard works as industrially dominated, the entire pharmaceutical profession should join in a vote of thanks to those manufacturers who have so generously shared their laboratory facilities and even their confidential records with the revision committees.

When the AMERICAN PHARMACEUTICAL ASSOCIATION completes the installation of this laboratory and transfers thereto the investigational program that has been so systematically begun under the direction of President Gathercoal, it will be able to demonstrate to the country its worthiness to be further entrusted with the preparation of pharmaceutical standards. We may then expect a really systematic review of all standards now being enforced, and be further assured that scientific accuracy and true enforceability are dominant factors in the production of any monograph. Every effort has been made to adhere to such a program in the past, and with the advent of a central laboratory the upholding of these ideals is even more certain. Every pharmacist in America should feel himself genuinely indebted to those generous donors who are aiding us in the accomplishment of this purpose.—G. D. B.

HOSPITAL PHARMACY.

FOUR recent developments in this field deserve more than passing attention and illustrate the splendid progress being made in improving pharmaceutical service in hospitals.

First, the Council on Medical Education and Hospitals of the American Medical Association, included the following reference to pharmacy in its sixteenth annual presentation of hospital data in the Hospital Number of the *Journal*, March 27, 1937:

"A total of 1419 hospitals reported that they employ 1901 pharmacists. Most, or all, of the states of the Union have laws regulating the practice of pharmacy, the handling of drugs in hospitals, as well as elsewhere, and provisions for registry under the state government.

"The 'Essentials of a Registered Hospital' require that 'the handling of drugs should be adequately supervised and should comply with state laws.' "

Second, the Sub-Section on Hospital Pharmacy of the AMERICAN PHARMACEUTICAL ASSOCIATION held its first session at the recent annual meeting in New York. In attendance, in the number and character of the papers presented and in the interest of those present, this first session was a success beyond the expectation of the officers who arranged it, and indicates a splendid future for this newest division of the ASSOCIATION. The Sub-Section on Hospital Pharmacy is now firmly established and provides the opportunity so long needed for hospital pharmacists to organize for professional advancement. The proceedings of the Sub-Section will be reported in the Proceedings Number, November issue, of the A. PH. A. JOURNAL.

Third, the Committee on Pharmacy submitted the second annual report to the American Hospital Association at its recent meeting in Atlantic City, which is remarkable in its outspoken estimate of the present unsatisfactory conditions in hospital pharmacy, in its searching conclusions as to what should be done, and in its broad recommendations to place pharmaceutical service on the proper professional basis in hospitals. Pharmacists should be encouraged by the scope and character of this report and of the first report submitted last year. They go beyond the usual limitations and frankly point out the relations which should exist between pharmacy and the other public health professions for the welfare of the patient.

Space permits only a few scattered quotations from the report:

"Society is now demanding good medical care and the public is entitled to as good pharmacy service as it may expect from other professions. Effective hospital service presupposes effective pharmacy service."

"No community or governmental agency should countenance any less degree of pharmacy service than medical service."

"The pharmacy service is of intimate concern to the doctor, the nurse, the pharmacist and the administrator. Heretofore, pharmacy operation has been considered a technical matter for the expert."

"Every hospital should strive for a system of rational therapeutics. It is not quite the hospital's job to instruct interns on prescription writing; that is the function of the medical school. The hospital is the place to practice the methods taught. It seems that most of the better medical schools apparently are lax in teaching prescription writing."

The conclusions are quoted below and it is the consensus of opinion of the committee that any hospital larger than one hundred beds warrants the employment of a registered pharmacist.

"Pharmacy is a highly specialized medical service. Few departments in hospital performance have been given less attention by and large than the hospital pharmacy. The present practice of drug therapy in hospitals is chaotic and requires revision. There is great economic loss in the operation of the average hospital pharmacy as it is to-day administered. The Committee on Pharmacy recommends that the Council on Community Relations and Administrative Practice of the American Hospital Association establish a division on pharmacy and take steps to prepare a manual of pharmacy operation and control. A system of rating hospital pharmacies is proposed.

"The Committee recommends that this Council emphasize the need of better relations between the professional schools of pharmacy, medicine and nursing. These professions cannot be indifferent to each other. More attention should be given to the education of the hospital personnel on pharmacy operation. It may be advantageous to have interns and nurses assigned to the pharmacy for short courses in drugs and solutions; hospital internships in pharmacy will, undoubtedly, raise the standard of pharmacy service. This is no little task.

"The Committee further recommends that the American Medical Association create a national research council similar to the Therapeutic Trials Committee in England.

"With the present position of the large commercial pharmaceutical establishments and the high pressure methods of advertising they employ, the physician and the public has become saturated with the supposed merits of fancy proprietary preparations. The art of prescription writing is fast becoming lost. Hospital drug prescribing is burdened with excessive economic and therapeutic losses. Single drug items of widely varying potency and price are stocked in hospital pharmacies. Highly active preparations and inert ones are stocked without proof of clinical value. Equally baneful is the common practice of buying very common drugs (*i. e.*, phenolphthalein) under a score of different names and prices merely because different staff members are unfamiliar with standard nomenclature when writing orders. Pharmacists are thus led into careless habits of specifying drugs and labeling.

"Such practice is undoubtedly traceable to correctable defects in medical education. A program to ameliorate this condition will bring together members of the various national associations interested in rational drug therapy. Leadership is necessary. It seems that the American Hospital Association is the logical association to undertake such a study in the interest of all hospitals.

"An attempt has been made in the preparation of this report to give an overview of the planning, policies and operation of the hospital pharmacy in the light of accepted practice. Legislation is only touched upon.

"A program of standardization is recommended. Standards of teaching, measures, practice, equipment and procedures need be formulated. Better research is essential.

"Every hospital should appoint an active committee of the staff designated as the "committee of pharmacy." All matters of policy, administration and control are under the jurisdiction of the committee. All drugs and preparations added to or deleted from the shelves of the pharmacy must have the approval of this committee.

"Rules and regulations governing the department and rules and regulations governing the personnel are essential for good management. A list of reference books to constitute a library is appended with an extensive bibliography of articles pertaining to hospital pharmacies. A system of stock inventory, records and standard formulary is recommended. A systematic plan should be followed in constructing the pharmacy department with special reference to dispensing, stores and manufacture. Strict adherence to laws should be observed. A plea for rational drug therapy is made, keeping paramount in mind the ultimate consumer—the patient.

"Pharmacy service is no less acute in the hospital specializing in the treatment of tuberculosis and other communicable diseases than in the general hospital. Poor pharmacy service should not be countenanced any more than poor medical service. A program to improve standards and economy apply equally in the general and speeial hospital field."

Fourth, a Hospital Conference which brings together hospital administrators from every section of the United States and Canada is conducted during the annual Convocation of the American College of Surgeons, held this year in Chicago, October 25th to 29th. The discussion of practically every phase of hospital operation was provided for in the program of this Conference and The Hospital Pharmacy was included among the topics considered at a Panel Round Table Conference on Thursday forenoon, October 28th. Chairman Edgar C. Hayhow, of the Committee on Pharmacy of the American Hospital Association, was scheduled to open the discussion and the report of this Committee was brought to the further attention of hospital administrators. It will be recalled that the American College of Surgeons adopted a minimum standard for the hospital pharmacy at its annual meeting held in Philadelphia last October.—E. F. K.

According to Prout and Adams:

"Simple ointment as it appears in the pharmacopœia apparently serves no purpose as a base in the official ointments. A comparative study of the basal constituents of ten pharmacopœial ointments with Simple Ointment showed but little difference in percentage strengths and in consistency.

"From this survey, it is suggested that Simple Ointment can be properly employed as a base in some of the pharmacopœial ointments."—From a paper before Section on Practical Pharmacy and Dispensing, New York meeting.

SCIENTIFIC SECTION

BOARD OF REVIEW OF PAPERS.—*Chairman*, F. E. Bibbins; H. M. Burlage, W. G. Crockett, E. V. Lynn, C. O. Lee, L. W. Rising, L. W. Rowe, Heber W. Youngken, Ralph E. Terry, Carl J. Klemme.

COMMON AND ORIENTAL CARDAMOMS.*

BY ARNO VIEHOEVER AND LE KYA SUNG.[1,2]

INTRODUCTION.

While considerable information has been collected concerning the official cardamom (*Elettaria Cardamomum* Maton), fruits belonging to the family of *Zingiberaceæ*, no critical survey has thus far been made to establish the exact relationship and the comparative value of several other varieties which are recognized articles of trade in other countries, especially those of the Orient. Certain varieties, widely cultivated, in China, for instance, and possessing a distinct flavor might equally deserve an official recognition. Although the study of products in laboratories, located far removed from the countries of origin and growth, always renders difficult final decisions as to the natural grouping of those varieties, some light, nevertheless, can be thrown upon the relationship and actual value of these forms, now classified both as Elettaria or Amomum species.

This difficult subject has not had the attention of the pharmacognosists until the time of Dr. Pereira, to whom we are indebted for his important observations, particularly on the pharmacognostical history of various species of Amomum, growing on the West Coast of Africa. Shortly afterward Guibourt of Paris has carefully conducted researches on certain species of cardamoms, which, although rarely met with in America or Europe, are important articles of trade among the Oriental countries.

To these Oriental Cardamomum species, esteemed highly by the majority of the Chinese physicians, Daniel Hanbury has favorably alluded in papers on some rare kinds of cardamom. He stated: "It is my hope that Europeans residing in the countries in question, who take an interest in natural history, may be stimulated to some exertion to discover the botanical origin and obtain further accounts regarding the culture, the collection and the uses of these productions, which, apart from their interest to the pharmacologist, are derived from plants, many of which, remarkable for a splendid inflorescence, would become valuable additions to the horticultural collections of this country (1)."

We shall record here the results of our investigation correlated with the data in the literature. In view of the official recognition of several species of cinnamon, ginger, etc., in the U. S. Pharmacopœia, there are good reasons to consider for adoption as official also some other important varieties of cardamom. Hence, critical evaluation of some of the Chinese varieties in the proper light is the object of the following pages.

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* Scientific Section, A. PH. A., Dallas meeting, 1936.

[1] Philadelphia College of Pharmacy and Science.

[2] From the Biological Laboratories and The Gross Laboratory for Biological and Biochemical Research.

PART I.

HISTORY OF THE DRUGS AND SPICES.

1. Origin, Use and Extent of Growth.—Although a drug of so striking a flavor as cardamom can hardly have been unknown to the Ancient classical writers, it cannot with certainty be identified in their writings. There has been considerable doubt in the origin of the name; whether the word cardamom is of Greek, Arabian or Indian derivation, still remains a matter of great obscurity. Elettari is the Malayan or native name of the plant in Malabar, while Cardamomum, Kapsauwuor is the name of some Indian spice used in classical times. However, the Greek nomenclature is apparently suggestive of "Delicious Spice."

According to Susruta, the author of "Ayurvedas," an old Sanskrit medical work in which a large number of Oriental drugs are mentioned, cardamoms, Elā, have been used in India from a remote period (2). The drug, being thought to have reached Europe prior to the Christian Era, is found to agree (though not exactly), in description with the Kapsauwuor of Theophrastus and Dioscorides, and Amomum or Amomis of Pliny.

In the curious list of Eastern Drugs and Spices, liable to taxation at the Roman Customhouse in Alexandria about 176–180 A.D., Amomum as well as Cardamomum are mentioned (3). It has been incidentally mentioned by St. Jerome in common with musk as perfumes used among the voluptuous Eccleciastics of the 4th century (4).

Hanbury reports in this Pharmacographia that cardamoms are named by Edrisi about A.D. 1154 as a production of Ceylon and also as an article of trade from China to Aden. In the same century, among the highly esteemed spices, cardamom is mentioned together with cinnamon and cloves in the long and interesting article by a pharmacist of Cairo, named Abul Mena.

Though the drug has found its way into Europe as early as the 12th century, only in the time of Garcia de Orta, 19th century, cardamom was brought to the careful attention of the world and became much valued in the European market.

Of the place of growth of cardamom the first distinct notice seems to be that of the Portuguese navigator, Barbosa, A.D. 1514, who, while searching for spices, discovered for the first time the cardamom as a product of the Malabar coast.

The early history of cardamoms renders it somewhat likely that the writers of the classical times have erroneously used the name for many other fruits of the family of Zingiberaceæ. It is scarcely possible to determine what products they actually referred to, as their notices of it are so brief and indefinite, though many believe it to have been the variety which we call *Elettaria Cardamomum*.

2. Brief Historical Discussion of the Rarer Cardamoms.—For the purpose of comparison we feel it necessary while discussing the history of cardamom in general, to briefly review facts concerning a few of those varieties which have some importance in pharmacy and medicine.

(*a*) *Amomum Cardamomum, L.*—The Cluster or Round Siam cardamom. Being considered of great rarity and obtained from a native plant of East Indies, the fruits reached Europe in the early part of the 17th century. Drug dealers at that time considered it as the only product to be used when Amomum was ordered. The chief source of supply is reported to have been Bangkok, Siam, where large shipments were made to England, China and Japan. In 1857, several batches of Bangkok cardamom were offered for sale in London and figures at 1s. 6d. per pound, cost price. The amount of drug exported to Singapore and China in 1871 was estimated to be 4678 piculs (623,733 pounds) (2). Hence it thoroughly testifies to the fact that the drug is an article of considerable traffic in Eastern Asia. The Round cardamom occurs in small compact bunches, possessing a strong camphoraceous and aromatic flavor, and having a general resemblance to that of the Malabar Cardamom (Elettaria Cardamomum). Round cardamoms are rarely employed

in this country, but they were formerly official in the French codex and Dublin Pharmacopœia. According to Hanbury, they are also mentioned in the celebrated Dispensatorium of Valerius Cordus.

The export of cardamoms from Siam is classified under two headings, "Best Cardamoms" and "Bastard Cardamoms." Bastard cardamoms are the product of one or more species of Amomum growing wild. This class comes almost entirely from Eastern Siam (5).

"Best Cardamoms" are probably derived entirely from cultivated plants; the species that yields them being Amomum Krervanh. This plant is chiefly grown in the provinces of Chantaburi and Krat. Plantations are made in the forests often in mountain valleys. In making these plantations the forest trees are not felled, but some clearing of the undergrowth is done.

In the five years ending March 31, 1930, the average annual export of "Best Cardamoms" was 1118 piculs, valued at Tcs. 234,417. In the same period the average annual export of "Bastard Cardamoms" was 4061 piculs, valued at Tcs. 205,418. Hongkong takes most of the export of both qualities.

(*b*) *Amomum Melegueta.*—This is the so-called Amomum grana-Paradise which furnishes the "Grains of Paradise" or guinea grains of commerce. The plant is native of Africa and has been transplanted in the West Indies. So far as known, it has never been found in Asia. Some writers have erroneously referred it to Amomum xanthioides which is now understood to be the "Bastard Cardamom." It is possible that the seeds of the latter variety have occasionally been used as a substitute for those of Amomum Melegueta, but they are nevertheless not the true "Grains of Paradise." The name Melegueta refers to the ancient empire of Melle of the upper Niger region of Africa. And again, Melegueta or Malaguelta is also said by Hanbury to be the African name of the seeds, though it is more probably of Spanish origin. But in modern Spanish the word is applied to various small pungent spices. Though the early history of grains of Paradise falls short of unauthentic record, there is an incidental allusion to its use as a spice, among the aborigines of West Africa. There are many references showing the fruits to have been employed in medicine in the 13th century. Again among important spices, the "Grains of Paradise" were used and mentioned by John, King of France, 1359–1360. Even Christopher Columbus, while voyaging to the coast of Guinea, has referred to it in connection with Costa Di Maniguetta, which later became a monopoly of the Kings of Portugal.

Grains of Paradise, as seen in commerce, agree in many respects with the seeds of the official cardamom, having a round, ovoid or somewhat wedge-shaped outline and shining golden, brown appearance. Their surface is slightly rough from the presence of small longitudinal striations, and internally they are white, when crushed and rubbed between the fingers, a characteristic aromatic odor is developed. They are highly esteemed by the native African as the most wholesome of spice; in Great Britain and the United States, it is primarily employed in the preparation of veterinary medicines, and to impart pungency to cordials. "Hippocrus," the famous spiced wine of the 14th century, was heavily flavored with grains of Paradise, cinnamon and ginger.

(*c*) *Ovoid China Cardamom.*—In the hands of modern pharmacognosists, the plant yielding Ovoid China cardamom has been referred to Amomum medium of Loureiro. It is described in the "Chinese Herbal" together with Alpinia globosum, from which it is with difficulty distinguished. It is a product of Southern China, and abundant in the drug shops of the latter. This cardamom is characterized by its large, hard, angular seeds, which alone seems sufficient to prove its distinctness from the other varieties of cardamom. The drug is employed by the Chinese in much the same cases as the Amomum globosum, to which it is preferred in the treatment of various gastric disorders. It should also be mentioned that the seeds have been formerly much used as a condiment or spice.

(*d*) *Amomum Villosum.*—This form is described by Loureiro to be a Cochin-Chinese species of Amomum, which has early been naturalized in China and is largely grown in the province of Kwan-Tung. Some writers have designated it the "Hairy China Cardamom." It is rather unfortunate that the Chinese have erroneously regarded it as identical with Amomum xanthioides (Bastard cardamom); and they are usually found on the market admixed with the seeds of the latter. The "Hairy China Cardamom" is sometimes sold with the stalk attached, sometimes removed from it. The stalk or scape, when perfect, measures 3–4 inches, carrying ten or twelve capsules. It is the scape that is beset with hairs and not the capsules. The same tonic and stomach properties are ascribed to the seeds of this plant as to those of cardamoms in general.

(*e*) *Amomum Amarum.*—"I-Chih-Tse" is the correct Chinese name for this special variety: the Bitter-Seeded Cardomom; the origin of which is still very little understood. The botanical origin is first mentioned by Guibourt who has (doubtfully) referred it to Zingiber nigrum of Gaertner, a plant identical with *Alpinia Allughas* of Roscoe, which is considered by Pereira and Hanbury to be a totally different species. The "Pun-Tsao-Kungmuh," a celebrated Chinese herbal, says that the fruits formerly occurred in Thibet and Cochin China, but are now chiefly produced in the Province Kwang-Tung.

Fig. 1.—1/2 × Official Malabar cardamom.

(*f*) *Amomum Globosum of Loureiro.*—(Tou-Kow or Tsao-Kow, Chinese.) The plant has been referred to *Alpinia globosa* by Stuart (6). It is actually the *Amomum globosum* Loureiro, described by Hanbury as "The Large Round Chinese Cardamom." The actual plant, furnishing the well-known Chinese cardamom in commerce, is still uncertain and is yet to be carefully studied by botanists. It is found to be early naturalized in Southern China, namely, the provinces of Kwang-Tung, Kwang-Si-Yunnan and Fukian. In commerce there is the so-called "Small Round China Cardamom," which Hanbury and Perrot consider simply a variety of the preceding. Both cardamoms and the flowers are used in Chinese medicine and reputed to counteract the effects of wine in the system.

Fig. 2.—1/2 × Long Ceylon cardamom.

An interesting botanical discussion of Alpinia, Amomum and Elettaria species, as possible or assured sources of cardamoms, has recently been given by Brandt and Wasicky (7); see also Tschirch (8).

For illustration of some of these cardamoms, official and non-official, including Oriental, see Figs. 1, 2, 3, 4, 5—all 1/2 natural size.

Fig. 3.—1/2 × Korarima (African) cardamom.

Part II.

Cultivation, Production and Commerce.

1. The plant of the *Elettaria Cardamomum* grows abundantly, both wild and under cultivation, in the mountainous districts of Indo-China, Ceylon and Southern India, at an elevation of 2500–5000 feet above the sea. It is also reported that the

place where cardamoms grow best has an average temperature of 22° C. and an average rainfall of 121 inches. The fruits are largely obtained from cultivated plants; and the gathering of the fruits before maturity commences in October and continues during dry weather for two or three months. However, the methods of cultivation vary considerably in the different localities.

In some moist shady mountain forests cultivators, shortly before the rainy season commences, usually locate a spot where some cardamom plants are growing. Not infrequently they root out the surrounding weeds that are decidedly injurious to the plants and at the same time

Fig. 4.—1/2 × Chinese Round cardamom.

a certain amount of light is admitted for the proper growth of the plant. The plant, having attained 2 to 3 feet in height, is well protected and left to itself for a year. At the end of the second year plants begin to flower, and bear fruits a year later. Plants thus remain productive for quite a few years.

The cardamom plants in Western Mysore are cultivated in the betel-nut regions and thus are raised between the palms, from which they derive the necessary amount of shade. They commence to bear fruits in their third year and these fruits are gathered from October to late in December. Either the entire spike may be cut or only ripe fruits may be plucked from the spikes. But these fruits are dried in different ways; thus in some cases, the white scape of fruits is gathered at once and dried; or the fruits, when collected, are carried to the houses and partially dried on mats for a few days. They are then stripped from their scapes and dried by a gentle fire-heat. Occasionally they have to be bleached by exposure to dew and sunlight or sulfurous acid and steam. The seeds are best kept in their pericarps, in which condition they are imported in chests, but when required for medicinal use the seeds should be separated from them and the pericarps discarded. Those seeds which have been removed from capsules become inferior in time through loss of volatile oil, responsible for the flavor, as compared to those that have been kept enclosed.

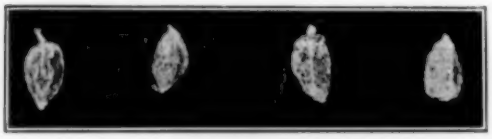

Fig. 5.—1/2 × Bitter cardamom.

Most of the drug goes through Bombay or Madras to the various parts of the world. The cardamom fruits are esteemed in proportion to their plumpness and heaviness and the sound and mature condition of the seeds they contain. In commerce they are found in the two forms of "Shorts" and "Shortlongs." The former variety is usually broad and plump, while the latter is finer ribbed and lighter than the "Shorts." The Malabar cardamoms are of the highest commercial value and consist of both varieties. The Mysore cardamom is considered to be the next best grade, consisting mostly of "Shorts," but being less pungent.

Beside the Malabar or official cardamoms, above described, cardamoms of other species, rather generally believed to have an inferior flavor, have been and are now widely employed in the Oriental countries. The forms mainly considered are the Amomum Globosum of Loureiro (Large Round Chinese cardamom) and the Chinese Bitter-Seeded cardamom.

2. The Round Chinese cardamom, as we have previously stated, is indigenous to Southern China (6). This evergreen plant, said to resemble the Myristica in appearance, now grows best both wild and under cultivation in the Kwang-Tung province. The flower has not yet been de-

scribed, but the other parts in many respects are similar to those of Elettaria Cardamomum. The plant as a rule thrives best in a light, moderately rich and well-drained soil which has been carefully prepared before planting. Though the fruits, furnishing the Round cardamoms of commerce are largely obtained from the cultivated variety, it is not at all uncommon to find that the latter is often admixed with that of the wild growing species. The seeds, from which the cultivated plant grows, should not be more than 2 years old and are sown dispersedly, covered one to two inches deep. Usually at the end of the second year fruits can be gathered in a ripened condition. Since the plants develop very slowly it is therefore not advantageous to sow the seeds in weedy soil.

3. The Bitter-Seeded cardamom grows wild in the shady forests, where slight admission of light helps the plant to develop in abundance. It is believed to grow better in moist soil, and growers do not seem to have much difficulty in germinating the seeds in the place where the climate is warm and damp. However, the writers have not succeeded in growing the seeds in the greenhouse and it is very likely that the seeds were not viable. But the plant, which produces this variety of bitter seeds is still not identified. The writers have also failed to obtain the true plant from the place of growth, namely, the province of Kwang-Tung. Hanbury states "Received from R. Swinhole, a specimen which he says is from Hainan, where the aborigines use it as tea. He adds that there is good reason to believe it to be the fruit of the Alpinia which yields the galanga root of commerce" (9).

In considering the commercial aspects of the two Chinese varieties, the market demand for these drugs is naturally the chief factor in determining the prospects for their commercial production under cultivation in the foreign countries. So far as studied, they are cultivated with benefit in China, where they are grown under conditions of soil and climate resembling those of many localities in the United States. Often the most suitable plants for a particular locality cannot be foretold, especially in those situations where no attempts have yet been made to grow them in the places other than the native. In such cases, it is therefore well to try and select for cultivation the plants like cardamoms which may thrive in the new situation under conditions closely resembling their old habitat. As a number of native medicinal plants, which in their wild state are restricted to certain localities, have been successfully cultivated in situations far beyond their natural range, there are good reasons to believe that Chinese cardamoms will thrive in sections where they are not now grown.

Annually, fairly large sums of money are expended for the official cardamoms (*Elletaria Cardamomum*), imported from Ceylon and India, where they are cultivated under conditions similar to that of many sections in the United States. As a means of guaranteeing the future supply of the spice in question and of alleviating the necessity of depending on specific importations, attention might well be directed to the possible cultivation of the various cardamom plants in this country. There is now a wide use and remunerative production of Chinese cardamom in China.

Part III.

BOTANICAL CHARACTERISTICS.

1. Plants. (a) General Morphology.—Large Round China Cardamom (Tou-Kow or Tsao-Kow).

The plant under consideration produces the large Round and small Round Chinese cardamom of commerce. It is attributed by M. Guibourt to the *Amomum globosum* of Loureiro. This species has been described and illustrated by Hanbury (10) "On Some Rare Kinds of Cardamom." But identity of the plant is still far from being conclusive. It is a native of South China and Cochin China, and is now widely cultivated in all parts of Kwang-Tung and Kwang Si, as well as in parts of Yunnan and Fukien.

Stuart describes the plant as follows: "The plant is said to resemble the Myristica in appearance, and bears a red flower, changing to yellow, in the axils of the leaves, which has some likeness to the Hibiscus. The leaves resemble those

of the Wild ginger, and are sometimes gathered in the miniature state in a similar manner to tea buds (6).

The plant of the wild growing variety, often confounded with those under cultivation, is much more difficult to propagate from the seeds than the cultivated species, commonly grown in previously prepared moist soil. Hence these species for cultivation in this country are not easily propagated but require special conditions if good results are to be realized.

THE BITTER-SEEDED CARDAMOM—AMOMUM.

The plant believed to be that of *Zingiber nigrum*, which is identical with *Alpinia Allughas*, a Cochin Chinese species, the origin of which is still somewhat doubtful. The Chinese term is also applied to *Nephelium longa*, but recent writers restrict it to the Bitter-Seeded cardamom. According to R. Swinhoe it is probably a fruit of the Alpinia which furnishes the galanga root of commerce.

This evergreen herbaceous perennial is said to resemble *Amomum Malegueta* (Grains of Paradise) in having a long, slender, branched rhizome and an erect stem. The flowering stem is usually 4–6 feet in height, bearing pinkish flowers of moderate size. Numerous green and leathery leaves are described by some of the native herbals.

(*b*) *Differentiation of Cardamomum Plants from Amomum Species.*—Cardamomum, which is mentioned in the Sanscrit writings, apparently derives its name from "KAPSAUWUOR," a designation for some Indian spice in classical times. Likewise Amomum, "AUWOUR" is accepted as the classical name of some undetermined Eastern spice-bearing plant. Being derived from a common origin, the terms are indiscriminately used by the botanists for the various fruits of the family Zingiberaceæ, grouped under the name of Cardamoms.

From a close examination of the characters by which they are distinguished and of the chief points of interest attached to them, the writers so far as they studied the taxonomy of the fruits in question have failed to agree with the general opinion of placing them under separate genera. From the standpoint of classification, in Elettaria the connective tissue of the flower shows no extension and combines the halves of anthers in their entire length, while there is either no extension or an insignificant extension of the connective in Amomum (Sect. Geanthus) and broad extension of connective in case of Amomum Sect. Euamomum (11). Apparently the points of differentiation of Amomum from Cardamomum are far from being conclusive.

2. Seeds. (*a*) *General Morphology of Forms Mainly Concerned.*—The fruit of the *Amomum globosum* of Loureiro constitutes the large and small Round Chinese cardamom of commerce. It is a round or globular capsule having an average diameter and thickness of 15 mm., weighs about 475 mg. The fruit is trivalved and loculicidally dehiscent, a breaking away of the valves from the septa or partitions.

Capsule:

Color: Externally—Pale yellow.
Internally—Very light shade of yellow.
Shape: Round or globular.
Surface Marking: Longitudinally streaked.
Inner Surface: Indistinct network markings.
Extremities: Pointed at both ends, surrounded by unicellular non-glandular hairs.
Texture: Thin and easily torn.
Taste: Slightly aromatic, practically tasteless.

Seeds:

Shape: Pyramidal or wedge-shaped.
Number: Average of 24 seeds in each pod, forming 3 coherent masses which are separated by a thin whitish membrane.
Size: Thickness—average 2.65 mm., maximum 3 mm., minimum 2.05 mm. Length: Average 3.5 mm., maximum 4 mm., minimum 3.25 mm.
Color: Brownish yellow.
Weight: Average 20 mg., maximum 24 mg., minimum 17 mg.

TABLE I.—GENERAL CHARACTERISTICS OF THE OFFICIAL AND THE CHINESE CARDAMOMS.

	Official Cardamom.	Large Round China Cardamom.	Bitter-Seeded Cardamom.
Shape of fruit	Ellipsoidal or ovoid	Round or globular	Oval or ovate oblong
Color	Light buff	Yellow	Dusky brown
Surface markings of the capsule	Longitudinally streaked	Interrupted longitudinal ridges	Lines of irregularly interrupted ridges
Texture of the capsule	Thin and papery	Thin and easily torn	Hard and coriaceous
Extremities	Round at base, contracted at apex, devoid of hair	Tapering at both extremities covered with numerous long non-glandular hairs	Pointed at both ends, having a few short hairs
Number of seeds in a fruit	15–30 seeds	Average about 24 seeds	25–30 seeds
Description of seeds	Brown, red or grey, irregularly angular transversely rugose and a depressed hilum, longitudinally grooved on one side	Seeds are brownish yellow, pyramidal or wedge - shaped with deep furrow on one side	Dark brown in color, obtusely angular but smaller than that of the round variety. They adhere firmly together. Each seed weighs about 14 mg.
Size of Seeds:	4 mm. in length. 3 mm. in diameter	Same as Elettaria	3.5 mm. in length. 2 mm. in diameter
Taste of Seeds	Aromatic and pungent	Distinctly aromatic in taste and smell	Bitter and myrrh-like

(*b*) *Anatomy-Histology.*—Microscopical Characteristics—Transverse sections of the Round Chinese cardamom seed show the following tissues from periphery toward the center.

TABLE II.—HISTOLOGICAL CHARACTERISTICS OF THE ROUND CHINESE CARDAMOM.

1. *Arillus,* a whitish transparent membrane of elongated cells loosely attached to the outside of the testa.
2. *Spermoderm consisting of:*

   (*a*) Epidermis—A single layer of big oblong cells with thickened walls. Width, 20μ; length, 50μ.
   (*b*) Cross-Cell—A very narrow layer of nearly isodiametric cells occasionally undifferentiated from the epidermal layer. Tannin is present.
   (*c*) Oil Cell—Big oil cells, usually devoid of oil globules. Length of the cells exceeds the width. It is usually a one-celled layer.
   (*d*) Parenchyma—An indistinct layer of tangentially elongated parenchyma cells with traces of brownish tannin contents.
   (*e*) Sclerenchyma—A layer of brownish stone cells with thickened walls, each having a distinct lumen, which is 12μ in diameter. Considerable amount

of tannin is found in these stone cells. Also the presence of silicic acid is detected by macerating the seeds in concentrated sulfuric acid. These cells are usually 16μ wide, 24μ long.

3. *Perisperm*, containing numerous starch grains and few aleurone grains. Calcium oxalate crystals found.
4. *Endosperm*, a narrow zone surrounding the embryo. Here crystals of calcium oxalate are also noticed.

(*c*) *Histology of the Bitter-Seeded Cardamon.*—Cross sections of the Bitter Seeds upon examination present the following microscopical characteristics.

TABLE III.—HISTOLOGICAL CHARACTERISTICS OF THE BITTER CHINESE CARDAMOM.

1. *Arillus*, Is usually detached.
2. *Spermoderm:*
   (*a*) Epidermis—A layer of thick-walled epidermal cells, which in cross section appear rectangular, while in surface view they are both polygonal and rectangular. Average cell measures 58μ in length and 24μ in width.
   (*b*) Cross-Cell—A single layer of pigment cells with brownish tannin contents and resin-like bodies.
   (*c*) Oil Cell—One-celled layer of rectangular oil cells, whose walls are slightly thicker than that of the Round China cardamom. The length of the cell is about half as broad as the width.
   (*d*) Parenchyma—Occasionally indistinguishable.
   (*e*) Sclerenchyma—These stone cells appear in much darker shade, dark brown; walls are excessively thickened, producing lumina of 8 to 9μ in diameter. Tannin and silicic acid are always present.
3. *Perisperm*—Consists largely of starch grains.
4. *Endosperm*—Enveloping the embryo, which is stained red with tincture of alkanna showing the presence of oil.

(*d*) *Histochemistry or Microchemistry. 1. Presence and Location of Silicic Acid.*—Silicic acid in the cardamoms is chiefly found in the sclerenchyma layer of the spermoderm. With respect to the identification of silica in cardamom as well as in other plant structures, stress should be laid upon the structure of the elements after ashing and the formation of characteristic crystals of sodium or potassium fluorsilicate upon treatment with hydrofluoric acid. However, the presence of silica in the sclerenchyma cells can also be readily detected by macerating the whole seed with concentrated sulfuric acid and after a short time treating with chromic acid solution and then washing with water and alcohol. Characteristic skeletons produced as a result of the reaction are conclusive for the test.

It should also be mentioned that both varieties of the Chinese cardamom under consideration render satisfactory results with all the tests just described; and the amount of silica found in the Bitter-Seeded is relatively greater than that of the Round variety.

2. Pigments, Tannins, etc.—Tannin occurs as a constituent of the cell-sap, and the cells containing it are the cross-cells, parenchyma cells, sclerenchyma cells of the spermoderm of the cardamom seeds. Its presence is frequently noted in making sections of the seeds with a razor; the liberated cell-sap is colored dark blue. It may also be determined by use of dilute solutions of methylene blue as proposed by Pfeffer, which colors the cell-sap blue, afterward precipitating the tannin. This reagent has the advantage that when used in very dilute solution (1–500,000) it does not injure the protoplasm of the living cells (12). Ferric chloride, ferric acetate and copper acetate are the few good reagents very frequently employed for the precipitation of tannin.

In comparing the amount of tannin present in cell structures of the Chinese cardamoms, especially in the sclerenchyma cells, the writers have found that there is also heavier precipitation of tannin in the Bitter variety.

Not infrequently, brownish resin-like bodies occur in the form of a cell-content, being present in the pigment layer (cross-cells) of the Bitter-Seeded cardamoms. Like the fixed oils, they are colored brownish or brownish black with osmic acid and are intensely colored with alkannin.

3. Volatile Oil or Flavoring Principle.—Volatile aromatic principles are found in the large clear cells of the seeds of both varieties which arise either as a metamorphosis of the cell-wall described by Tschirch as a "resinogenous layer" or merely as an indirect product connected with photosynthesis.

The volatile oil present in the Bitter cardamom is distinguished by containing the bitter substances which are characteristic of the oil as well as the seed.

The oils are colored a carmine red with very dilute solutions of fuchsin. They also readily respond to osmic acid, alkannin, sudan III and cyanin.

4. Calcium Oxalate.—In the localization of the crystals of calcium oxalate in the cardamom seeds, the polarization-microscope is distinctly of value. These crystals are chiefly found in the perisperm tissue and occasionally in the endosperm. Aside from the optical method employed, resorcin-sulfuric acid for identifying calcium oxalate gives an intense blue color with oxalic acid or calcium oxalate. The test is brought about by adding concentrated sulfuric acid to the section and then resorcin in amounts sufficient to effect the reaction (13).

5. Starch, Fixed Oil and Aleurone Grains.—The perisperm is loaded with starch grains which, when treated with chlorzinc iodine solution, is colored blue, while embryo and endosperm are unaffected by the same reagent.

The presence of fatty oil in the embryo is indicated by the fact that the latter is readily stained pink with tincture of alkanna.

Aleurone grains, mainly found in the endosperm tissue, may be detected by the use of eosin-picric acid. Take the section (oils are previously removed by alcohol, or alcohol and ether) and leave it for 15 minutes in a saturated aqueous solution of picric acid. Transfer it to alcohol. Next treat the section with rather dark aqueous eosin solution for a few minutes, followed by alcohol and then xylol. The aleurone grains are either colored red with eosin or yellow with picric acid.

PART IV.

CHEMICAL CHARACTERISTICS.

(*a*) *Isolation of Oil—Steam Distillation.*—The most valuable constituent of cardamom is the essential oil, of which the seeds of the Round variety yield 4 to 6 per cent and the Bitter-Seeded 2 per cent.

The oil of cardamom was first distilled in 1540 by Valerius Cordus. An oil prepared "by extraction from the seed," as suggested by the critic, would be far from satisfactory. His sample made as described, "by taking the cardamom seeds, grinding them and extracting with a solvent and evaporating the solvent," was probably not more than one-half to one-third pure essential oil, because fixed oil in this seed is more abundant than the volatile. The ordinary solvents would extract this and leave it in the residue on evaporation (14).

Steam distillation was first recommended in 1826 by H. Zeise and especially for volatile oils by Van Dijk in Utrecht who thereby materially aided in its introduction. He demonstrated that the volatile oils which were obtained by steam alone from the vegetable material, distinguished themselves from those obtained by distillation over open fire, by a lighter color and purer odor.

By the distillation of the seeds of the Chinese cardamoms with steam the essential oils in question are obtained. The exact procedure employed in isolating the oil of cardamom in the laboratory is as follows:

The seed used for analysis should remain in the husks, and always be freshly ground, as the exposed or powdered material is apt to lose strength through volatility (15). One hundred grams of the seed in the form of moderately fine powder are placed in a liter flask; 500 cc. of water are added. The mixture is macerated for 15–20 minutes and then distilled with steam long enough (3 hours) to insure complete extraction. A Florentine receiver is frequently employed to collect

TABLE IV.—COMPARATIVE STUDY

	Elettaria Cardamomum.	Elettaria Cardamomum B.	Chinese Round Cardamom.	Bitter-Sweet Cardamomum.	Amomum Cardamomum L.
Specific Gravity	0.923–0.944	0.895–0.906	0.965–0.975	0.985–0.987	0.905
Optical Rotation	A_D +24° to +41°	+12° to +15°			+38° 4′
Congealing Point	Fraction of 150°–164° C. (17). Solidifies in a freezing mixture		Does not congeal at −5° C.	9° C. A portion does not congeal at 3° C.	Semi-solid at ordinary temperature
Melting Point	M. p. cineol 112° −113°. M. p. *d* - a - terpineol (18) 35°–37°	A solid crystal line (20) substance melts at 60°–61° — distillation residue		Camphor - like crystals melt at 110°–112° C.	42° (Oil)
Refractive Index	N_{D20}° 1.462–1.467		1.462	N_{D30}° 1.471	
Solubility	Soluble in 2–5 vols. 70% alcohol	1–2 vols. 80% alcohol	4.5 vols. 80% alcohol	5 volumes 80% alcohol	1.2 vols. of 80% alcohol
Acid Figure	A. V. up to 4.0	25–75	1.5–3	7.5	
Saponification Figure	132	25 to 70	25–35	81–87	18.8
Ester Figure	94–150			60–62	
Percentage Yield	3%; 5%; 7% Pericarp—0.2% (19)	4%–6%; Seed 4%; Pericarp 0.2%	5%	2%–3%	2.4% (17)
Color	Light yellow	Light yellow	Straw Yel.	Yellowish brown	
Odor	Penetrating but agreeable	Strong aromatic	Distinctly aromatic	Pungent	Distinct odor of camphor and borneol
Taste	Camphoraceous burning taste	Pleasant cooling taste	Camphoraceous and cooling	Camphoraceous and bitter	
Constituents isolated; their behavior toward certain reagents	The acid constituent of the ester is acetic acid forming. No formic, no higher fatty acids present. High saponification value due to terpineol acetate from saponified oil fractionation in vacuum yielded crystallizable *d*-a terpineol. M. p. 35°–37°; A_D +81° 37′ in the supercooled state. The first or lowest fraction cineol identified by iodol compound melting at 112°–113°	Fractional portion between 165°–167° + HCl yield terpinene dihydrochloride melting at 52°. Terpinene nitrosite of fraction of 178° to 182° melting at 155°. Fraction of 205°–220° + HCl a hydrochloride melting at 52° and by shaking it with conc. Hi, a hydriodide melting at 76°—terpineol −4° (Wallach) (18)	Oil boils at 170° C.	Oil boils at 200° C. with partial decomposition acquiring a dark brown color	Saponification value after acetylization raised to 77.2 and contained alcohols 22.5% borneol. From 800 Gm. of the oil 100 Gm. of the solid compound were obtained by centrifugal action. They consist of equal parts of *d*-borneol and *d*-camphor (21)

OF THE OILS OF CARDAMOM.

Amomum Melegueta.	Amomum Xanthoides.	Amomum Villosum.	Kameroon Cardamom	Amomum Aromaticum.	Galanga Cardamom.	Ovoid China Cardamom.	Amomum Augustifolium.	Cardamom Root of Indo-China.
0.894 (20) 0.825 (2)			0.907	0.920			0.9017	0.9066
−4° −3°58′			−20°34′ −23.5° Hansel	−13°			−16°50′	−32°57′
			1.4675				1.46911	1.48151
10 vols. of 70% alcohol			7–8 vols. 80% alcohol				6 vols. 80% alcohol	0.5 vol. 95% alcohol
			50, 107 after acetylization				0.4	3.7
							4.2	87.9 96.7 (after acetylization)
0.3% (2) 0.75% (17)			2.33% 1.60%	1.12%			4.5%	
Faint yellowish			1.60% (18)				Colorless	Lemon-yellow
Agreeable and spicy but not characteristic		Aromatic tar-like	Odor of cineol	Highly aromatic	Aroma resembles zalange root	Terchinthinate odor	Res. cajuput oil	Peculiar spicy odor
Aromatic, not acrid taste	Distinguishable from the peculiar aromatic taste of the oil of Malabar Cardamom (1)	Warm and bitter and tar-like (5)		Camphoraceous	Pungent burning	Woody and terchinthinate		
The oil begins to boil at 236°, the larger portion passing over between 257° and 258°. Analysis yielded results in agreement with the formula $C_{10}H_{20}O$. The oil dissolves iodine without explosion			The peculiar odor prevents its use as substitute for Ceylon cardamom	Large quantities of cineol				Oil contains cineol, bisaboline and paraffin owing to the presence of paraffin the residue left upon distillation solidified at 15° C.

the distillate, and by this means the separation of the light oily layer from the accompanying water is effected. Then the distillate is saturated with salt and extracted with ether. However, in the course of operation, the cooling surface effected by the condenser causes the deposition of whitish camphor-like bodies, accompanying the distillate. They are also rendered soluble in ether and removed by the use of the same reagent.

(*b*) *The Isolation of Oil-Extraction with Solvents.*—The problem of extracting the oil from the aqueous distillate, obtained through steam distillation, requires the selection of suitable solvents. The solvent most commonly used is ether which will extract the oil very readily, without producing any turbidity. The ethereal solution is preferably dried over anhydrous sodium sulfate and the greater part of the ether is distilled off, the remaining portions being allowed to evaporate spontaneously.

Less frequently petroleum ether is used since it caused incomplete solubility, the turbidity noticed when the distillate comes in contact with petroleum ether.

Likewise, carbon disulfide is not serviceable and moreover the extract always retained some of the disagreeable odor of the solvent. Neither has carbon tetrachloride proved satisfactory.

(*c*) *Composition of the Oil* (*Volatile*).—The analysis of the volatile oil of cardamom is always a difficult subject because most of the constituents are liquid in character and can, therefore, be separated only by fractional distillation. But this operation is also unsatisfactory because certain constituents of the oil are not volatile without decomposition. For this and other reasons it is best to subject the oil to a preliminary examination, the results of which simplify the examination considerably. It consists primarily in the determination of the physical properties of the oil; and also in the study of the behavior of the oil toward certain group reagents, whereby the presence or absence of certain constituents can be ascertained.

Of the physical constants, the specific gravity, the optical activity, boiling point and the congealing point help one to draw conclusions as to its chemical composition.

Results of the comparative physical and chemical study of the oils of cardamom with the chief points of differentiation are tabulated in Table IV.

The oil of the Round cardamoms is light yellow in color, somewhat viscid, has a strong odor of cardamom and a characteristic pleasant cooling taste. The specific gravity lies between 0.965 and 0.975. This may indicate a mixture of compounds which in the main are suggestive of terpenes and camphor. The oil is soluble in 4–5 vols. of 80 per cent alcohol.

At a temperature somewhat below the ordinary temperature the oil of the Bitter-Seeded cardamoms (which is deeper in color than the preceeding and has a bitter taste) forms a semi-solid substance with a strong camphoraceous odor. In order to dissolve the separated crystals, the oil has to be heated to about 40° C.; at which temperature the specific gravity is 0.985 and refractive index is 1.471 (30° C.). Saponification value 87.03; acid value 7.5; soluble in 5 volumes of 80 per cent alcohol. The oil boiling at 200° C. acquires a dark brown color with partial decomposition.

The camphor-like crystalline bodies accompanying the distillate in the distillation of both varieties with steam are found to be present in much less amount in the oil of Round cardamoms than that of the Bitter-Seeded cardamoms. These crystals upon repeated purification with ether or benzol tend to melt at 110–112° C. with the aid of so-called "micromelting-point apparatus," which was used in connection with the microsublimation of plant products in the Bureau of Chemistry, Washington, D. C. (16).

PART V.

PREPARATIONS AND USES.

Cardamoms owe their properties essentially to the presence of the volatile oil, the effects of which are in the main agreeably aromatic, usually devoid of acridity. For this and other reasons, the uses of various cardamoms will more or less be collectively discussed. Cardamoms are used either on account of their flavor or for their carminative and stimulant properties. The seed or the oil is, however,

rarely prescribed alone, but frequently employed as adjuvants or correctives of cordial, tonic and purgative medicines.

In China, tonic, stomachic, cordial, pectoral and astringent properties are ascribed to the fruits of the Bitter-Seeded cardamoms, and the occasional use to which they are applied at the present time is in the treatment of urinary troubles and chronic coughs. The seeds alone are used, and are given in the form of a decoction for affections of the stomach, or as a tincture in ague, malarial or intermittent fever, catarrh, or other systemic diseases (22). But the fruits of the Round Chinese cardamom are believed to be of value in cases of "heartburn" (pyrosis), vomiting, flatulent dyspepsia. They are also reputed to be serviceable in ague and disorders arising from drunken dissipation. They are said to have been formerly much used as a condiment or spice.

Cardamoms are but little used in the United States and Great Britain, being only employed in medicine, and to a very limited extent as an ingredient in the preparation of the condiment known as Curry Powder. Hence the consumption is small in comparison with what it is in Russia, Sweden, Norway and parts of Germany, where they are constantly employed as a spice for the flavoring of cakes (23). In these countries Ceylon cardamoms are also used, but exclusively for the manufacture of liquors. But in the East Indies, besides their medicinal use, they are largely consumed as a condiment and for chewing with betel, as described under "Areca Catechu," by Bentley and Trimen.

U. S. P., N. F., B. P., PREPARATIONS, ETC.

Though cardamoms enter into a considerable number of pharmaceutical preparations, only two derive their names from these fruits, namely, Tinctura Cardamomi Composita and Oleum Cardamomi. Cardamom, however, constitutes an important ingredient in Pulvis Aromaticus of N. F. and Pulvis Cinnamomi Compositus of B. P.

Owing to the presence of the fixed oil, the seeds are very difficult to powder alone. Hence the practice, in preparing compound powders containing cardamom, of mixing the other ingredients with it, so that they may absorb the oil.

Among the important preparations of cardamom, the compound tincture of cardamom deserves individual consideration especially in reference to their incompatibilities. Dunning mentions the possibility of tannin in compound tincture of cardamom, causing precipitation of alkaloid strychnine (24). Likewise, McCutcheon and Alexander discuss the incompatibility of the preparation with sodium bromide, with bismuth mixtures and with alkaloidal salts (25).

OFFICIAL PREPARATIONS WITH CARDAMOM.

		Official in
I.	From the Seed	
1.	Tinctura Cardamomi Composita	U. S. P. XI
2.	Tinctura Gentiana Composita	U. S. P. XI
3.	Pulvis Aromaticus	N. F. VI
4.	Pulvis Cretæ Aromaticus	N. F. VI
5.	Extractum Colocynthidis Compositum	N. F. VI
6.	Pilulæ Aloes et Myrrhæ (from Pulvis Aromaticum)	N. F. VI
7.	Pilulæ Hydrargyri Chloridi Mitis Compositæ (Containing Compound Extract of Colocynthidis)	N. F. VI
8.	Oleum Cardamom	N. F. VI
II.	Containing Volatile Oil	
9.	Spiritus Cardamomi Compositus	N. F. VI
10.	Spiritus Vanillini Compositus	N. F. VI
III.	Containing Compound Spirit of Cardamom	
11.	Elixir Cardamomi Compositum	N. F. VI
12.	Elixir Glycyrophosphatum Compositum	N. F. VI
IV.	Containing Compound Spirit of Vanillin	
13.	Elixir Vanillin Compositum	N. F. VI
14.	Elixir of Barbital	N. F. VI

V. Containing the Compound Tincture of Cardamom

15.	Elixir Euphorbiæ Compositum	N. F. VI
16.	Elixir Gentianæ	N. F. VI
17.	Elixir Gentianæ et Ferri	N. F. VI
18.	Elixir Gentianæ Glycerinatum	N. F. VI
19.	Elixir Glycerophosphatum Compositum	N. F. VI
20.	Elixir Taraxaci Compositum	N. F. VI
21.	Elixir Viburni Opuli Compositum	N. F. VI
22.	Elixir Viburni Prunifolia	N. F. VI

SUMMARY.

1. The close relationship of fruits obtained from Elettaria Cardamomum, yielding the official Malabar cardamoms, and those from several Amomum species appears well established as a result of the survey, based on literary, morphological and chemical evidence.

2. The character and percentage yield of volatile oil obtained from the Round Chinese cardamom suggest that the fruit might well be used as a substitute of, if not an equal to, the fruit of the official Malabar cardamom.

3. The Bitter Chinese cardamom, while chemically closely related to the other cardamoms, contains a bitter crystalline camphor, melting at 110–112° C.

4. The anatomical and chemical data obtained should greatly facilitate the identification of cardamom fruits, whether obtained from Elettaria or Amomum species.

5. The various differences observed between Elettaria Cardamomum and Amomum species appear not marked enough to justify separation in different genera.

6. Attention is called to new sources of supplies, both for condimental and medicinal uses; these supplies can be readily obtained through more extensive importations or possibly through domestic cultivation.

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ASSAY OF SPIRIT OF CAMPHOR.*

BY SAMUEL W. GOLDSTEIN AND WILLIAM F. REINDOLLAR.[1]

The assay of Spirit of Camphor official in the United States Pharmacopœia XI has been found very unsatisfactory in this Laboratory. The first supplement to the United States Pharmacopœia XI provides for the use of a 5-cc. sample, and it has been suggested that a further reduction of the amount of sample to 2 cc. is advisable (1). The official method involves treatment of the sample with solution of dinitrophenylhydrazine, refluxing on a water-bath for four hours, diluting and setting aside for twenty-four hours, collecting, drying and weighing the precipitate, and multiplying the resulting weight by a factor. We have found that the above reaction is not stoichiometric, the reagent used is exceedingly unstable, the procedure requires at least twenty-nine hours, and the results are unreliable.

The method recommended by Randall (2) is based upon precipitation of the camphor by an acidified aqueous calcium chloride solution in a Babcock bottle, dissolving the camphor in 1 cc. of benzin and, after centrifuging, noting the increase in volume, which when multiplied by a factor gives the per cent w/v of camphor in the spirit. This method, in the hands of one of us, gave unsatisfactory results, owing principally to the volatility of the benzin; hence a modified procedure has been developed.

EXPERIMENTAL.

Two samples of Spirit of Camphor were prepared by dissolving 9.7905 Gm. of natural camphor (A) and 9.8359 Gm. of synthetic camphor (B) in enough alcohol to make 100 cc.

Results obtained following the U. S. P. XI procedure are given in Table I.

TABLE I.—U. S. P. XI PROCEDURE.

Sample.	Amt. Used in Cc.	Gm. Camphor per 100 Cc.	Results Calcd. to 10% Spirit.
A	5	5.84	5.92
B	5	7.20	7.32
B	5	5.58	5.67
B	2	9.30	9.46
B	2	9.30	9.46
B	2	9.50	9.65
B	2	10.05	10.21
B	2	9.00	9.15
B	2	9.15	9.30
B	2	9.20	9.45

* Scientific Section, A. PH. A., New York meeting, 1937.

[1] From the laboratories of the Bureau of Chemistry of the State of Maryland Department of Health.

The use of 2-cc. samples gave much better results, but even with the smaller charge the figures show errors between +2.1 per cent and −8.5 per cent.

The factors involved in the following experiments were exactly the same as those brought out by the present authors in an earlier paper (3) on Spirit of Peppermint. The only factor which differs in the case of Spirit of Camphor is the volume relationship between the kerosene and the dissolved substance. In the case of oil of peppermint and kerosene the total volume observed is, for practical purposes, exactly additive; whereas in the case of camphor and kerosene the final volume is greater than the sum of the individual volumes. Therefore, the factor 4 which may be used in the assay of Spirit of Peppermint cannot be used for Spirit of Camphor. Since, however, a factor is required it was determined for Gm. of camphor per 100 cc. of spirit.

A weighed sample of camphor, 2.8375 Gm. was dissolved in 5 cc. of purified kerosene in a calibrated graduated 10-cc. cylinder. The final volume was 8.01 cc., or an increase of 3.01 cc. as a result of the added camphor. Five Babcock divisions are equivalent to 1 cc., hence 0.5 Gm. of camphor (the amount in a 5-cc. sample of Spirit) is equivalent to 2.67 Babcock divisions. The factor required to express the above result in Gm. per 100 cc. of Spirit is $\frac{10.00}{2.67}$ or 3.75.

The following method is recommended for the assay of Spirit of Camphor. *Apparatus.*—Calibrated 8 per cent Babcock bottles; a pipette calibrated to deliver 1 cc. of kerosene; an accurate 5-cc. pipette. *Reagents.*—A concentrated solution of calcium chloride, in 4 per cent hydrochloric acid, having a specific gravity of 1.36 (approximately 818 Gm. $CaCl_2$ to each 1000 cc. of 4 per cent HCl solution); purified kerosene U. S. P. XI. *Procedure.*—Transfer exactly 5 cc. of the Spirit to a calibrated Babcock bottle, graduated to 8 per cent, add acidified calcium chloride solution (specific gravity 1.36) until the bottle is filled to the shoulder, stopper the bottle with a cork previously wetted with calcium chloride solution and mix the contents vigorously. Add exactly 1 cc. of purified kerosene from a pipette calibrated to deliver that amount, stopper and agitate the mixture for about one minute. Add acidified calcium chloride solution to bring the liquid up to the highest mark in the neck of the bottle, stopper and centrifuge for five minutes at about 1500 revolutions per minute. Observe the number of divisions occupied by the oily layer, reading the lower curvature of the menisci, subtract five divisions for the kerosene added and multiply the remaining number by 3.75. The product is the number of grams of camphor in 100 cc. of the Spirit.

The following results were obtained using 5-cc. samples of Spirits A and B employing the procedure described. Three different lots of purified kerosenes (1, 2 and 3) and one commercial kerosene (4) were used.

TABLE II.—RESULTS BY RECOMMENDED ASSAY.

Sample.	Kerosene.	Gm./100 Cc.	Results Calcd. to 10% Spirit.
A	1	9.75	9.96
A	1	9.78	9.99
A	1	9.75	9.96
B	1	9.94	10.11
B	1	9.90	10.07
B	1	9.83	9.99
A	2	9.75	9.96
A	2	9.71	9.92
A	2	9.78	9.99
A	2	9.67	9.88
A	2	9.72	9.92
B	2	9.75	9.92
B	2	9.67	9.84

B	2	9.75	9.92
B	3	9.90	10.07
B	3	9.94	10.11
B	3	9.94	10.11
B	4	9.83	9.99
B	4	9.90	10.07
B	4	9.78	9.94

These figures show that the results obtained by the recommended assay lie within the range −1.6 per cent and +1.1 per cent, and that this accuracy is maintained with kerosenes obtained from different sources.

SUMMARY.

The present assay given in the United States Pharmacopœia XI for Spirit of Camphor is both inaccurate and time consuming.

A modified assay based on the procedure of Randall has been devised. This assay yields results that lie within ±2 per cent of the theoretical value and which when obtained in duplicate are in good agreement.

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THE HOBBY OF A DRUGGIST.

Joseph V. Tallman, a pioneer of Pendleton, Oregon, and collector of arrowheads for forty-eight years or more, has a collection of 20,000 arrowheads. He has donated eight beautiful specimens, through Secretary E. F. Kelly, for the Museum of the AMERICAN PHARMACEUTICAL ASSOCIATION. The collection is said to be one of the largest, if not the largest, in this country and there are rich shades of stone, cornelians, agates, etc. Many of these arrowheads come from Yellowstone Park. A long description by L. C. Dixon is published in the *Portland Journal* of January 3, 1937.

Mr. Tallman has written the following beautiful tribute to arrowheads:

"Sharp and true, the handiwork of the ancient artisans—buffeted by endless time and harassed by the elements—lie before us glistening in barbaric splendor, relic of a powerful empire—a mighty race.

"Together with the bones of the master craftsmen who wrought these mementoes of stone is buried the secret of his craft, an art lost to even his own descendants—a mystery unsolved by modern science.

"Challenging the human imagination, we observe the arrowhead—delicate, yet strong as steel—beautiful, yet formidable. We cannot, in due appreciation, contemplate these ancient works without paying tribute to the hand and heart which wrought them."

CHEMICAL AND CLINICAL ASPECTS OF SODIUM PERBORATE THERAPY.*[1]

BY L. L. MANCHEY AND S. LEE.

The wide-spread use of sodium perborate as an adjunct in the treatment of Vincent's infection and in related conditions has brought to the attention of the dental and medical professions certain attending untoward effects. Bloodgood (1), who in 1910 suggested its use in the treatment of Vincent's infection, later reported (2) that too frequent treatment produces an irritation. Hirschfeld (3) has attributed a number of cases of chemical burns, slight edema of the lips and instances of hairy tongue to the too frequent use of sodium perborate preparations.

The undesirable effects from the drug have been ascribed variously to a number of possible causes: to impurities present in the compound, such as sodium hydroxide (4); to sodium hydroxide regarded not as an impurity but as a hydrolytic product of the parent compound (2); to prolonged contact of undissolved salt with the oral tissues through failure to remove it by adequate rinsing (2); to individual idiosyncrasy to the compound (4); to essential oils used as flavoring agents.

Interest appears to have centered in particular in alkalinity as the cause of the ill effects. In this connection, the following equations adapted from Mellor's Comprehensive Treatise (5) have been cited elsewhere (1) as an illustration of the theoretical decomposition of sodium perborate in water to sodium hydroxide and other products.

$$4NaBO_3 + 5H_2O \rightarrow 4H_2O_2 + 2NaOH + Na_2B_4O_7$$
$$Na_2B_4O_7 + H_2O \rightarrow 2HBO_2 + 2NaBO_2$$
$$2NaBO_2 + 2H_2O \rightarrow 2HBO_2 + 2NaOH$$

The circumstance that Vincent's infection is caused supposedly by the anærobic Vincent's fusiform bacillus and spirillum existing either in symbiosis or as varied forms of the same organism leads *a priori* to the commonly accepted view that the value of the compound as a drug depends upon the release of oxygen when it is brought in contact with the affected tissue. Indeed, the implication in the majority of allusions to its therapeutic application is that the oxygen which is lost in gaseous form, rather than the active oxygen, manifests the virtue of the compound. This attitude is difficult to reconcile with the antibacterial properties of hydrogen peroxide (6), (7), which is less efficient in the presence of certain kinds of organic matter where the decomposition and liberation of oxygen is greatly accelerated.

According to the U. S. P. XI, the salt is soluble at 25° C. to the extent of 1 Gm. in about 40 cc. of water, and by definition should contain not less than 9 per cent of available oxygen. In view of the U. S. P. data for solubility and the minimum permitted available oxygen content it is doubtful whether, under the conditions of use, the total dissolved available oxygen representing both undecomposed sodium perborate and the hydrogen peroxide ever greatly exceeds 0.3 per cent.

The decomposition of sodium perborate to yield hydrogen peroxide is greatly accelerated by acids or acid salts and the rate of solution and apparent solubility

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* Scientific Section, A. PH. A., New York meeting, 1937.

[1] From the research laboratories of Vick Chemical Company, New York, N. Y.

are noticeably increased. By carefully adjusting the proportions and concentrations of perborate and acid, the p_H of their aqueous solutions may be brought within desirable limits for use in the mouth, while by limiting the amount of water the dissolved available oxygen is increased many fold above that of saturated solutions of sodium perborate. Thus while the objections which weigh most heavily against the use of sodium perborate, *viz.*, its high alkalinity and the possibility of retaining undissolved salt in contact with the oral tissues have been surmounted, greater flexibility in the hydrogen peroxide concentration is made possible to suit the peculiarities of individual requirements.

Numerous reports (5), (8), (9), (10), (11) have appeared in the literature that solutions of higher available oxygen content may be obtained with sodium perborate by the addition of tartaric, citric, boric and other acids.

Whereas the significance of such common acids in conjunction with sodium perborate was well understood, it was not until the greater adaptability of monocalcium phosphate for dental and oral applications was brought to our notice[1] that its probable superior merit was considered.

In contradistinction to the organic acids, the phosphate may be credited with the advantage of affording by reaction with sodium perborate insoluble phosphates of calcium. Mixtures of sodium perborate and monocalcium phosphate for cleaning the teeth thus combine a certain degree of mechanical cleansing with the advantages of higher concentrations of available oxygen in solution. Such mixtures may find use, therefore, either as tooth powder or mouth rinse.

The intent of this investigation has been to determine the flexibility of the perborate-phosphate composition in relation to p_H and to stability; and to ascertain the relations between composition and effects upon the oral tissues. In the preparation of the perborate-phosphate mixtures, sodium perborate was used in the form of monohydrate instead of U. S. P. tetrahydrate.

EXPERIMENTAL.

The indicator strip method, according to Wulff (12), (13) was employed in the determination of p_H. It combines the simplicity of colorimetric methods with applicability to opaque or colored mixtures, and is, moreover, within the limits of precision required by the practical aspects of our studies. The technique followed involved a slight departure from the procedure recommended for alkaline solutions. The modified method is as follows: An indicator strip covering the desired range is subdivided into small pieces about 4 x 8 mm. One of the pieces is folded by means of a blunt-tipped forceps through the middle to form a "V" and is then placed directly on the scale holder with the color standard adjusted. Two drops of the test liquid are placed on the "V" strip which is then covered quickly with a microscope slide to prevent absorption of carbon dioxide and acid vapors from the atmosphere. Care is exercised that the microscope slide is not pressed too tightly against the indicator strip to cause it to flatten and become fixed against one of the opposing glass surfaces; otherwise the liquid is not free to permeate both sides of the strip, and the time for the indicator change is unnecessarily prolonged.

By oscillating the slide on one of its ends held against the pane of the scale holder as a fulcrum adequate circulation of liquid is ensured. By this method, the color changes may be followed directly with the eye without the uncertainty experienced by the operator of over- or underexposing the strips by the usual method. Despite the contact between liquid and air engendered by the oscillations, mixtures such as the ones investigated here are sufficiently buffered to eradicate the effects of atmospheric carbon dioxide.

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[1] Dr. Paul Poetschke.

In the discussion which follows, the values given for p_H, unless otherwise qualified, represent measurements made at room temperature at a predetermined contact time between water and powder following which there were shown to be no further fluctuations in the acid-base equilibrium. A fifteen-minute interval was shown experimentally to provide adequate time for equilibrium to be established. This was demonstrated by following the change in p_H with time to a constant value in suspensions of 5 Gm. of variable composition mixtures of sodium perborate monohydrate and mono-calcium phosphate in 100 cc. of distilled water.

With pure perborate either as monohydrate or as tetrahydrate the value remained unaltered at 10.3 between 15 minutes and 48 hours following the introduction of the powder into the water. Concentration of the perborate in water of 10, 15 and 20 per cent $\left(\frac{w}{w}\right)$ did not affect the reading. For pure monocalcium phosphate, however, the value dropped from 3.8 in 15 minutes to 3.4 in 48 hours; nor were constant readings obtained in 15 minutes with mixtures of the two in which the monocalcium phosphate was present in excess of 65 parts per 100 parts of mixed powder. This is without doubt explained by the presence of phosphate in excess of the amount required to effect complete decomposition of the perborate and to the relatively slower solution rate of the phosphate in the absence of perborate. Mixtures containing less than 65 per cent of monocalcium phosphate afforded constant readings in less than 15 minutes.

Presumptive of the dual applicability of a properly adjusted mixture for use either as a powder on the brush or as a rinse in higher dilution, the p_H-composition relation was followed in suspensions of the mixtures in water at two levels representing tentatively adopted limits of concentration. The proportions used were 4 Gm. of mixture to 100 cc. of distilled water for the weak suspension and 5 Gm. of mixture to 10 cc. of distilled water for the more concentrated form. The procedure was to stir the mixture of powder and water frequently during 10 minutes, allow 5 minutes for sedimentation and then determine the p_H following the modified method described above. The results are depicted graphically in Fig. 1. It is evident from the curve illustrating the more concentrated suspension that the acid-base equilibria within the composition range 40 parts sodium perborate: 60 parts monocalcium phosphate and 60 parts sodium perborate: 40 parts monocalcium phosphate lie approximately within the extreme limits of p_H reported for saliva from healthy normal subjects. Starr (14) found the reaction to vary from p_H 5.75 to 7.05.

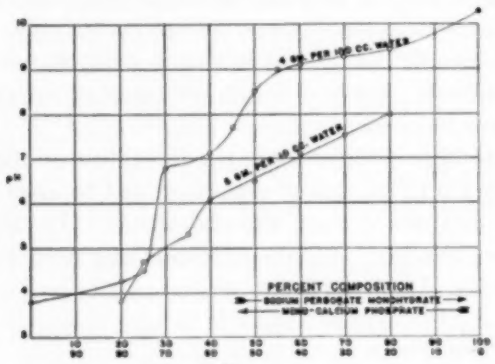

Fig. 1.

The upper curve shows that in higher dilution, within the same range, the alkalinity of sodium perborate has been significantly lowered.

Consequently the limits $^3/_2$ and $^2/_3$ were placed upon the perborate/phosphate composition ratio of mixtures used in preliminary tests to ascertain their effects in comparison with sodium perborate upon the oral tissues. The clinical phases of the investigation will be found more fully described toward the close of the report.

Stability of Sodium Perborate at High Humidity in the Presence of Monocalcium Phosphate.—Into a series of vials $^7/_8$ x $2^1/_2$ inches were weighed separately varying amounts of sodium perborate monohydrate and monocalcium phosphate, so that the combined weights amounted to approximately 0.5 Gm. The components were thoroughly mixed by rotating the vials, which were then placed in an upright position in a humidor over diluted sulfuric acid affording at 25° C. a relative humidity of 75.6%. Periodically, vials were selected according to sodium perborate content and assayed for available oxygen by the U. S. P. XI method. In Fig. 2 is shown the loss in available oxygen occurring in the samples over a storage period of 40 days. The sodium perborate monohydrate used in these mixtures originally assayed 14.8% available oxygen. The graph

clearly shows that the stability of the perborate is greatest in the presence of limited amounts of monocalicum phosphate.

It seemed a reasonable assumption that sodium perborate monohydrate would afford more stable mixtures with an anhydrous or partially dehydrated form of monocalcium phosphate than with the usual commercial monohydrates.

This assumption appeared even more plausible when it was shown that the tendency to cake was definitely less in mixtures with the dehydrated form. The observations were made upon mixtures for which the perborate/phosphate ratio of one group was $^1/_2$ and for a second group, $^2/_3$. Equal amounts of the mixtures were exposed to an atmosphere of high moisture content under identical conditions of temperature, humidity, surface area and time.

As a more decisive test, bulk samples, representing three tentative formulas, each containing the same per cent and form of sodium perborate, but differing in perborate/phosphate ratios and in the character of the monocalcium phosphate were kept in dentifrice cans fitted with composition screw-cap closures and later assayed for deterioration of sodium perborate. Included in the formulas were flavoring oils and sufficient polishing agent (tricalcium phosphate), chemically indifferent to the perborate and monocalcium phosphate, to make a total of 100 parts of finished prod-

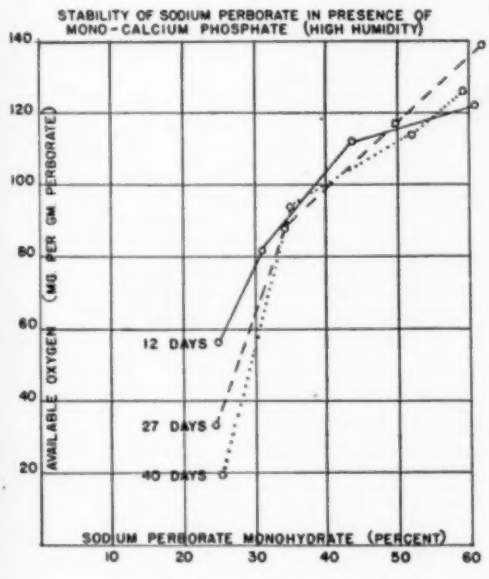

Fig. 2.

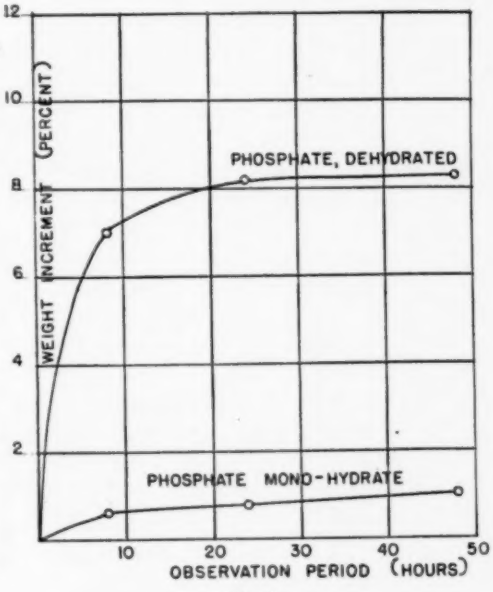

Fig. 3.

uct. The quantity of polishing agent varied in the samples according to their perborate/phosphate ratios. The sodium perborate employed for this purpose was in the form of monohydrate, milled to a No. 150 average mesh, and assayed 15.0 per cent available oxygen after milling. Other characteristics of the finished mixture are given in Table I.

TABLE I.—CHARACTERISTICS AND EFFECTS OF STORAGE AT HIGH HUMIDITY AND TEMPERATURE.

Sample.	Ratio Perborate/ Phosphate.	Per Cent Perborate Mono-hydrate.	p_H.*	Per Cent Original Available Oxygen.	Per Cent Loss in Total Available Oxygen. Humidity— 88.5 Per Cent Temp.—100° F., Days—22.	Humidity— 88.5 Per Cent Temp.—Room, Days—22.
40	0.66	30	6.6	4.60	16.7	4.5
41	1.25	30	7.2	4.62	26.0	4.3
42	1.20	30	7.1	4.64	33.6	14.2
Sodium Perborate Tetrahydrate				10.05 to 10.20	70.0	20.0

* Determinations made 15 minutes after suspending 5-Gm. samples in 10 cc. distilled water.

Both Samples 40 and 41 contained the dehydrated form of monocalcium phosphate. The regular monohydrate was used in Sample 42. Screening analyses gave for the dehydrated form, 95 per cent; and for the monohydrate, 98 per cent through a No. 200 mesh screen. The conditions of storage are indicated in the table. A well-known brand of sodium perborate tetrahydrate similarly packaged was included under each condition of test.

The figures reported for loss in available oxygen show that the perborate is more stable in the presence of dehydrated phosphate, under the conditions of test, than in the presence of the monohydrate; that under the conditions indicated, tetrahydrated sodium perborate loses more of its available oxygen per gram than its monohydrate in the presence of sufficient monocalcium phosphate, either as monohydrate or the dehydrated form, to nearly neutralize the alkalinity of the perborate.

It is worthy of mention that the affinities of the two forms of phosphates for moisture run more or less parallel with their influence upon the stability of the perborate. In Fig. 3 it will be seen that the rate of moisture absorption is greater for the dehydrated phosphate. This data was obtained by exposing quantities of the phosphates to a humid atmosphere to constant weight. Approximately one Gm. of the phosphates, accurately weighed, was spread out uniformly on two-inch watch glasses and placed at room temperature over diluted sulfuric acid, affording at 25° C. a relative humidity of 75.6 per cent.

Differences in the neutralization rates with Samples 40, 41 and 42 are suggested by the figures shown in Table II.

TABLE II.—CHANGE IN p_H OF AQUEOUS SUSPENSIONS

Minutes.	Sample 40.	Sample 41.	Sample 42.	Sodium Perborate Tetrahydrate (U. S. P.).
1	6.7	7.3	7.5	10.2
2	6.6	7.3	7.4	10.3
4	6.6	7.2	7.3	10.3
7	6.6	7.2	7.2	10.3
10	6.6	7.2	7.1	10.3
15	6.6	7.2	7.1	10.3
30	6.6	7.2	7.1	10.3

The p_H values given are for readings taken at intervals on suspensions of 5 Gm. of mixture in 10 cc. of distilled water. It will be seen that whereas the perborate/phosphate ratio for 41 (dehydrated phosphate) is slightly greater than that for 42 (monohydrate) the rate of neutralization is greater, and the time for reaction to be completed is less. These distinctions must be attributed to the difference in the physical characteristics of the phosphates.

EFFECTS UPON ORAL TISSUES.[1]

The initial tests conducted in connection with this phase of the investigation were intended to reveal whether under similar conditions of application, sodium perborate, U. S. P. XI, and mixtures of sodium perborate monohydrate with monocalcium phosphate would produce inflammatory reactions in contact with the oral tissues. For this purpose small cotton cloth bags of dimensions $3^1/_2$ x $2^1/_2$ cm. and containing 0.75 Gm. of the test material were placed between the gum and lip of the lower jaw of human subjects. Two perborate-phosphate mixtures, representing, respectively, perborate/phosphate ratios of $^3/_2$ and $^2/_3$, were applied in conjunction with U. S. P. perborate to the gums of a number of individuals in the manner described. When retained *in situ* for 30 minutes, the U. S. P. perborate produced erythema, edema and in some instances vesication of the tissues in direct contact with the poultices. With the mixtures, the results in general were the same except that there seemed to be a greater tendency toward stimulation of tissue circulation

[1] These studies were conducted by Joseph Schroff, M.D., D.D.S.

with less necrosis and sloughing. Burning sensations on the lip and tip of the tongue were noted also. The degree of discomfort varied according to the time the poultices were held in place. Individual variations were observed, but the same persons responded to repeated tests in the same manner.

The effects noted in the instance of the perborate-phosphate mixtures were attributed to the high concentration of hydrogen peroxide formed by reaction at the site of contact between tissue and poultice under conditions such that the volume of fluid was small as compared with the test material. A similar conjecture could hardly explain the effects from U. S. P. perborate where, as has been previously suggested, the hydrogen peroxide concentration is limited by the low solubility of the salt.

In a second series of tests conducted in a similar manner with poultices of perborate-phosphate mixtures having a perborate/phosphate ratio of 1.22, but with sufficient added inert material to reduce the perborate concentration in three different mixtures to 10, 20 and 30 per cent of perborate monohydrate, respectively, inflammatory reactions on the mucous membrane of the mouth were negligible. Only restricted areas of hyperemia or very slight discomfort were produced in a few individuals by the 30 per cent mixture. No reactions were elicited by the 10 and 20 per cent perborate mixtures; nor was any change in the response caused by decreasing the perborate ratio in the 30 per cent mixture from 1.22 to 1.0. This alteration in perborate/phosphate ratio corresponds to a change in p_H of from 7.4 for the 1.22 ratio to 6.6 for the 1.0 ratio. Concurrent with the poultice tests made with the material represented by the 1.0 ratio, control tests were made on the same and different individuals with a mixture containing no monocalcium phosphate, but with sufficient inert material to give a perborate concentration of 30 per cent. Soreness and severe inflammation of the tissues were caused only by the control mixture.

SUMMARY AND CONCLUSIONS.

1. Monocalcium phosphate has been shown to reduce effectively the alkalinity of sodium perborate, thereby removing a common objection to its use in the treatment of Vincent's infection and allied conditions.

2. Neutralization is sufficiently rapid to be of practical importance in dental therapeutic applications.

3. Insoluble phosphates of calcium are formed by reaction between sodium perborate and monocalcium phosphate which are of value in a dentifrice because of their mechanical cleansing properties.

4. Monocalcium phosphate augments the solution rate and the apparent solubility of sodium perborate so that the benefits of the potential water-soluble available oxygen may be more quickly and more fully realized.

5. If stored under conditions approximating the maximum humidity and temperature of any climate, sodium perborate tetrahydrate (U. S. P.) has been shown to be less stable than sodium perborate in the form of monohydrate when 30 parts of the latter are mixed with from 20 to 37.5 parts of dehydrated monocalcium phosphate and sufficient tricalcium phosphate to make 100 parts.

6. Sodium perborate tetrahydrate (U. S. P.) has been shown to cause harmful effects when applied to the gums of normal healthy human subjects.

7. Similar harmful effects were caused by a mixture of 30 parts of sodium perborate monohydrate and 70 parts of inert tricalcium phosphate.

8. No harmful effects were caused by a mixture of 30 parts of sodium perborate monohydrate, 45 parts of dehydrated monocalcium phosphate and 25 parts of inert tricalcium phosphate.

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The following quotation from an article by A. Schmierer, in the *Pharmaceutical Journal*, deals with the post-graduate education of German pharmacists.

"In order to provide for the maintenance and extension of the scientific knowledge and practical skill of pharmacists, the German pharmaceutical authorities have established an institution for post-graduate education which arranges for classes and courses of instruction to be held in all parts of Germany. The work is divided between seven main departments and one special department. The main departments are (1) pharmaceutical chemistry, (2) botany and pharmacognosy, (3) applied pharmacy, (4) pharmacology, (5) law, (6) administration, (7) history of pharmacy. The special department includes race and population policy, social policy, health policy, gas and air protection, etc. The instruction may be given in the form of single lectures, series of lectures, evening courses, week-end courses, and full-time courses.

"Every German pharmacist is under an obligation to receive instruction in all the departments to an extent which accords with his circumstances and opportunities of attendance. The obligation is enforceable, but so far no necessity for enforcement has arisen. The cost of instruction is borne partly by the authorities and partly by the individual pharmacist, although in special cases the pharmacist's contribution is remitted. During the first session, which extended over last winter, the demand for instruction was greater than could be fulfilled; 3995 pharmacists participated in the arrangements, approximately 25 per cent of the total number of pharmacists in Germany. The courses are held in the pharmaceutical institutes of universities; in hospital, district, and teaching pharmacies; in technical high schools; and in other schools and laboratories.

"At the conclusion of a course each student is given a certificate and a written summary of the work of the course; he is also given tests to carry out in his pharmacy. Special emphasis is laid on practical work and the use of illustrative material such as films, projections, models, preparations, pictures and experiments. The work in the various departments includes investigation of drugs and medical specialties, simple urine analysis, blood sugar determinations, pregnancy tests, and alcohol in blood tests, microscopical investigations of drugs and drug powders, action of drugs, preparation and testing of apparatus for durability and efficiency, bookkeeping and business administration."

NOTES ON ANTISEPTIC SOLUTION—NATIONAL FORMULARY.*

BY WILLIAM C. CLARK.[1]

In the manufacture of antiseptic solution of the National Formulary, much of the expensive, active ingredients is removed by filtration because of the lack of solubility under these conditions. An approximation indicates that possibly as much as eighty per cent of these valuable ingredients is removed by filtration.

Apparently the revision committee of the National Formulary is aware of difficulties in this preparation because the formula for antiseptic solution is different in each of the last three National Formularies. It appears that the omission of sodium benzoate and sodium salicylate in N. F. V left something to be desired in antiseptic properties for N. F. VI has included chlorthymol, a germicide which has six times the germicidal activity of thymol. This inclusion would make an ideal preparation from a germicidal standpoint, if the chlorthymol were all dissolved. This, however, does not happen; for if the solution is filtered brilliantly clear before the addition of chlorthymol and then chlorthymol is added, oily drops separate.

Possibly the omission of sodium benzoate and sodium salicylate was made with the object of reducing the tendency of this solution to color and also to improve the taste. The coloration was very slight and as far as the taste is concerned the flavoring ingredients completely hide any sweetish saline taste that these salts impart. Two very valuable properties are lost by this omission; one is the loss of the antiseptic power of these two salts and any synergestic action which these salts may have, the other is the surface tension lowering produced by these salts.

The following facts indicate that antiseptic solution of the National Formulary VI does not contain all of the valuable constituents used in the formula.

1. It requires approximately four and one-half times the official volume of alcohol 30, water 70 to completely dissolve all the constituents.
2. The solution as prepared in 1 compares favorably in germicidal power with the official antiseptic solution.
3. On chilling the official solution and the solution described in 1 both become cloudy within 1° C. of the other. The official solution clouds about 1° C. higher than the dilution.
4. Thymol and chlorthymol are very soluble in the other aromatic and oily constituents; therefore the oily residue which is present before filtration must dissolve most of the thymol and chlorthymol. A coarse approximation indicates that more than three-fourths of these active materials are lost.
5. Theoretically chlorthymol with a phenol coefficient of 120 and thymol with a phenol coefficient of 20 should make a solution equal to a 14 per cent solution of phenol if all of these substances are present.

Chlorthymol	0.1 Gm. × 120 =	12.0 Gm. phenol
Thymol	0.1 Gm. × 20 =	2.0 Gm. phenol
		14.0 Gm. Phenol in 100 cc.

A three per cent solution of phenol is recognized as an effective germicide and therefore if all of the valuable constituents are present in the official antiseptic solution 14/3 or one part of antiseptic solution diluted with about 3.6 parts of water

* Scientific Section, A. PH. A., New York meeting, 1937.

[1] Bacteriological Laboratory, James F. Ballard, Inc.

to make 4.6 parts of solution should be an effective germicide. However, the National Formulary directs that the official antiseptic solution be used undiluted, because if it is diluted appreciably it loses its germicidal power for the lack of germicide.

When tested bacteriologically a 1:1000 solution of thymol kills *Staphylococcus aureus* of prescribed resistance when tested at 37° C. within five minutes, using the Food and Drug Administration Phenol Coefficient Method. Chlorthymol has six times the phenol coefficient of thymol; hence a 1:6000 solution of chlorthymol should be equal to a 1:1000 thymol, or a dilution of one part of antiseptic solution N. F. VI in water to make seven parts should kill, but it does not kill because all the germicidal substances are not present. Nevertheless, when all the germicidal substances are dissolved in appropriate solvents the solution kills *Staphylococcus aureus* under test conditions even when diluted 1 part in ten.

Considering the added antiseptic power of boric acid, oil of thyme and the other flavoring constituents, these results are to be expected. However, if we compare the N. F. antiseptic solution with phenol we find this solution has a coefficient of approximately 0.03 instead of 0.14 which it should possess. This fact indicates the loss of germicidal substances.

Bacteriological tests on official antiseptic solution and on certain control samples. Tests are for germicides at 20° C. and 37° C.

ANTISEPTIC SOLUTIONS AT 20° C.

Control.	5 Min.	10 Min.	15 Min.
1:60 Phenol	x	—	—
1:70 Phenol	x	x	x
1:3 Antiseptic Sol. N. F. VI	x (1 min.)	x (3 min.)	x (5 min.) x (10 min.)

	1 Min.	2 Min.	3 Min.	4 Min.	5 Min.
1:2 Antiseptic Sol. N. F. VI	x	x	x	x	x
1:8 Antiseptic Sol. Special I	x	x	—	—	—
1:8 Antiseptic Sol. Special II	x	—	—	—	—

x = growth

Special I is made using N. F. VI Formula except *70* parts *alcohol* and *30* parts *water* and *no* talcum.

Special II is made using N. F. VI Formula except 30 parts alcohol, 25 parts of propylene glycol and water *q. s.* 100 parts. No talcum. The phenol equivalent of the thymol and chlorthymol is still greater than 1:60 phenol. It is equal to 1.75% phenol instead of 1.66% phenol.

ANTISEPTIC SOLUTIONS AT 37° C.

Control.	5 Min.	10 Min.	15 Min.
1:80 Phenol	x	—	—
1:90 Phenol	x	x	x

	1 Min.	2 Min.	3 Min	5 Min.
Antiseptic Solution A 4.5:10	x	x	—	—
Antiseptic Solution B 1:10	x	—	—	—
Antiseptic Solution C 1:10	x	—	—	—
Antiseptic Sol. N. F. VI 1:3	x	x	x	x
Antiseptic Sol. N. F. VI Undiluted	x	x	—	—

x = growth

Antiseptic solution "A" was prepared using all the ingredients present in 100 cc. of the official solution except that no talcum was used and 450 cc. of a 70 per cent water 30 per cent alcohol v/v was used for the solvent. This solution was further diluted by using 4.5 cc. of the above solution in sufficient water to make 10 cc. Actually there is present a 1:10 dilution of the active ingredients which should be present in the official solution.

Antiseptic solution "B" was made using the N. F. VI formula and replacing 25% of water with 25% of propylene glycol. Nothing else was omitted except that no talcum was used. One part of the above solution was diluted with water to make 10 parts for the test.

Antiseptic solution "C" was made from N. F. VI quantities except that the alcohol was increased to 70 per cent and a 1:10 dilution was tested. No talcum was used as a clarifier in the manufacture of antiseptic solution A, B or C, in order to avoid loss by absorption.

Solution B and C has the phenol equivalent in thymol and chlorthymol of 1.4 per cent phenol and a 1:80 solution of phenol is 1.25 per cent; therefore, considering the other antiseptics present, killing should be expected in these two dilutions.

Tests indicate that almost forty per cent of alcohol is required to completely dissolve all the constituents. Also, each ingredient individually is completely soluble in the official solvent. Two of the ingredients may be dissolved in the solvent in several instances, but thymol, chlorthymol, eucalyptol, oil of thyme and menthol are closely related chemically and each is only sparingly soluble; therefore, after thymol and chlorthymol have been dissolved in the liquid, the addition of menthol promptly forms a liquid and refuses to dissolve. Apparently a eutectic is formed. The addition of eucalyptol or oil of thyme also forms an insoluble oily liquid.

There are three possible solutions to this problem: (1) Increase alcohol to about forty per cent, (2) use of the newer non-toxic propylene glycol and (3) finally decrease the flavoring constituents such as eucalyptol and menthol very much and decreasing the thymol and chlorthymol just enough to form a clear solution. Numerous other solvents were tried without any appreciable success. Glycerin is of no practical value in effecting solution.

CONCLUSION.

The formula for antiseptic solution of National Formulary VI needs revision. Materials are wasted and consequently the solution is not as effective as it should be for the quantity of materials used. Either the quantities of antiseptics or the character of the solvent must be changed to avoid this needless waste.

By replacing 25 per cent of the water in N. F. VI antiseptic solution with propylene glycol, a solution is made that mixes well with water, requires no clarifying agent, and may be diluted with two parts of water to form a highly effective germicide. Propylene glycol seems to cause the formation of a more pleasant odor and taste in the product. The problem can also be solved very easily by increasing the alcohol to 70 parts by volume which results in a preparation that mixes clear with all proportions of water and is an effective germicide when mixed with two parts of water. Of course any mouthwash or gargle should be effective long after the recommended dilution has been exceeded in order to take care of the dilution which takes place during use.

The author acknowledges indebtedness to the Carbide and Carbon Chemical Co. for generous samples of various glycols and solvents.

SHIKIMIC ACID AND DERIVATIVES.*

I. SALTS OF SHIKIMIC ACID.

BY HSING-HAN LEI.[1]

A. Salts of Metals.—The following salts of metals have been described thus far, *viz.*, those of sodium, potassium, magnesium, calcium, strontium, barium and lead. Apparently the three hydroxy groups in shikimic acid interfere with the isolation of simple salts in crystalline form. Previous work has been repeated and attempts to prepare new salts were made.

Lithium Shikimate.—This was made by the action of shikimic acid on lithium carbonate in the presence of water. The product was amorphous. Being difficultly soluble in organic solvents, recrystallization did not prove satisfactory. When heated with xylene to remove moisture (3.4 p. c.), it was obtained in slightly colored scales. Analyses yielded the following results:

1. 0.2001 Gm. gave 0.059 Gm. Li_2SO_4, corresponding to 3.72 p. c. Li.
2. 0.2045 Gm. gave 0.061 Gm. Li_2SO_4, corresponding to 3.76 p. c. Li.

The theoretical percentage is 3.86 p. c.

Sodium Shikimate.—This is one of the few salts previously described. It was obtained by Eykman (1) in 1891 as "large rhombic sphenoids." It was again prepared by S. Y. Chen (2) in 1929. No difficulty was experienced in its preparation. When analyzed, the following results were obtained:

1. 0.2675 Gm. yielded 0.0830 Gm. Na_2SO_4 = 10.05 p. c. Na.
2. 0.3220 Gm. yielded 0.1005 Gm. Na_2SO_4 = 10.11 p. c. Na.

Calculated for $C_6H_6(OH)_3COONa$ ..... 11.74 p. c.
$C_6H_6(OH)_3COONa.2H_2O$ ..... 9.91 p. c.
$C_6H_6(OH)_3COONa.H_2O$ ..... 10.75 p. c.

Potassium Shikimate.—This salt was obtained in an amorphous condition by S. Y. Chen (3) in 1929. Repetition of the experiment yielded crystals as large as those of the sodium salt. However, when prepared from an alcoholic medium needle-shaped crystals resulted.

When analyzed, the following results were obtained:

1. 0.3172 Gm. yielded 0.1332 Gm. K_2SO_4 = 18.84 p. c. K.
2. 0.2035 Gm. yielded 0.0835 Gm. K_2SO_4 = 18.41 p. c. K.

Computed for $C_6H_6(OH)_3COOK$ ..... 18.43 p. c. K.

Silver Shikimate.—This salt was obtained by heating the acid with freshly precipitated silver oxide in the presence of water. Recrystallized from water, it was obtained in prisms.

Upon analysis the following results were obtained:

1. 0.2327 Gm. yielded 0.0892 Gm. Ag corresponding to 38.33 p. c. Ag.
2. 0.2270 Gm. yielded 0.1020 Gm. Ag corresponding to 38.24 p. c. Ag.

Computed for $C_6H_6(OH)_3COOAg$ = 38.41 p. c.

Copper Shikimate was obtained by heating the acid with freshly precipitated

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* Scientific Section, A. PH. A., New York meeting, 1937.

[1] From the laboratory of Edward Kremers.

cupric hydroxide suspended in water. A brownish green crystalline product resulted upon evaporation of the filtrate (from the excess $Cu(OH)_2$). It is insoluble in organic solvents, but dissolves in concentrated alkali (without precipitation of cupric hydroxide).

Distilled with xylene it yielded 7.4 p. c. of water, corresponding to a dihydrate. The dehydrated salt was red in color. When analyzed, the following results were obtained:

1. 0.1910 Gm. yielded 0.0320 Gm. CuO corresponding to 13.38 p. c. Cu.
2. 0.1447 Gm. yielded 0.0247 Gm. CuO corresponding to 13.63 p. c. Cu.

Computed for $(C_6H_6(OH)_3COO)_2Cu$ = 15.52 p. c.
Computed for $(C_6H_6(OH)_3COO)_2Cu.3H_2O$ = 13.71 p. c.

Chen in 1929 called attention to the fact that a strongly alkaline solution of shikimic acid mixed with a solution of copper sulfate yields a solution similar to Fehling's solution (8). Like tartaric acid, shikimic acid is a hydroxy acid.

Magnesium Shikimate.—This was reported by S. Y. Chen in 1929 (4). The salt was obtained in an amorphous condition from magnesium carbonate and shikimic acid in the presence of water. The amorphous mass is very hygroscopic and difficultly soluble in organic solvents. When heated with xylene to remove moisture (15 p. c.) slightly colored microscales were obtained which are no longer hygroscopic.

Analysis yielded the following results:

1. 0.1792-Gm. sample gave 0.0190 Gm. MgO corresponding to 6.63 p. c. Mg.
2. 0.1870-Gm. sample gave 0.0201 Gm. MgO corresponding to 6.48 p. c. Mg.

Computed for $(C_7H_9O_5)_2Mg$ = 6.57 p. c.

Calcium Shikimate.—It was prepared by Oswald in 1891 (5); also by S. Y. Chen in 1929 (6). The salt was made by neutralizing shikimic acid with milk of lime. A crystalline compound was obtained. It can be precipitated from its aqueous solution by methyl alcohol and can be crystallized from dilute alcohol.

Analysis yielded the following results:

1. 0.2040-Gm. sample gave 0.0627 Gm. $CaSO_4$ corresponding to 9.05 p. c. Ca.
2. 0.2493-Gm. sample gave 0.0765 Gm. $CaSO_4$ corresponding to 9.04 p. c. Ca.

Computed for $(C_7H_9O_5)_2Ca$ = 10.37 p. c.
Computed for $(C_7H_9O_5)_2Ca.3H_2O$ = 9.11 p. c.

The salt may be crystallized with three molecules of water.
Oswald reported with $6H_2O$.

Strontium Shikimate.—It also was prepared by Oswald in 1891 (7); again by S. Y. Chen in 1929 (8). Repetition of their experiments yielded a powder. It is slightly soluble in acetone and very difficultly soluble in other organic solvents.

Analysis yielded the following results:

1. 0.2492-Gm. sample gave 0.0982 Gm. $SrSO_4$ corresponding to 18.37 p. c. Sr.
2. 0.2524-Gm. sample gave 0.0997 Gm. $SrSO_4$ corresponding to 18.84 p. c. Sr.

Computed for $(C_7H_9O_5)_2Sr$ = 20.21 p. c.
Computed for $(C_7H_9O_5)_2Sr.2H_2O$ = 18.66 p. c.

Oswald also reported $2H_2O$ of crystallization.

Barium Shikimate.—This was likewise prepared by Oswald in 1891 (9); also by S. Y. Chen in 1929 (10). An amorphous brittle mass was obtained by heating barium carbonate and shikimic acid with water. Like the lithium salt it is very difficultly soluble in organic solvents.

Analysis yielded the following results:

1. 0.2102-Gm. sample gave 0.0877 Gm. $BaSO_4$ corresponding to 24.56 p. c. Ba.
2. 0.2672-Gm. sample gave 0.1120 Gm. $BaSO_4$ corresponding to 24.67 p. c. Ba.

Computed for $(C_7H_9O_5)_2Ba$ = 28.42 p. c.
Computed for $(C_7H_9O_5)_2Ba.4H_2O$ = 24.74 p. c.

Oswald reported no water of crystallization.

Lead Shikimate.—This was made by the action of shikimic acid on lead carbonate in the presence of water. An amorphous brittle mass was obtained as Chen reported in 1929. Attempts to recrystallize it from organic solvents were not successful. When heated with xylene to remove moisture (5.5 p. c.), it was obtained in yellowish brown scales.

Analysis yielded the following results:

1. 0.321-Gm. sample gave 0.169 Gm. $PbSO_4$ corresponding to 35.97 p. c. Pb.
2. 0.3085-Gm. sample gave 0.162 Gm. $PbSO_4$ corresponding to 35.87 p. c. Pb.

Computed for $(C_7H_9O_5)_2Pb$ = 37.45 p. c.
Computed for $(C_7H_9O_5)_2Pb.2H_2O$ = 35.98 p. c.

Zinc Shikimate.—This salt was obtained from zinc carbonate and shikimic acid in aqueous solution. It can be purified by recrystallizing from water or by dissolving in water and then precipitated with alcohol. It was obtained in crystalline form. Upon analysis the following results were obtained:

1. 0.1988 Gm. yielded 0.0395 Gm. ZnO corresponding to 15.96 p. c. Zn.
2. 0.1484 Gm. yielded 0.03 Gm. ZnO corresponding to 16.23 p. c. Zn.
3. 0.1059 Gm. yielded 0.0211 Gm. ZnO corresponding to 15.96 p. c. Zn.

The theoretical percentage is 15.89.

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Dr. William E. Weiss gave the address of welcome to the convention of the National Wholesale Druggists at White Sulphur Springs, West Virginia, on October 4th. He made the following timely statement:

"Any new plan, law or proposal which fails to consider the wholesaler, the manufacturer, the retailer, the employees of our industry and the general public—which favors one or more at the expense of another—no matter how bright and promising it may appear when first examined, it must eventually fail to accomplish any permanent good purpose."

THE CORRECTION OF INCOMPATIBILITIES IN PRESCRIPTIONS. I.*

BY WILLIAM J. HUSA[1] AND HERBERT M. WEBB.

In the present-day practice of pharmacy a real pharmacist finds many opportunities to be of service by avoiding or correcting incompatibilities in prescriptions. Every physican who has any originality or capacity for professional development will frequently prescribe new combinations of medicaments. In many cases such original prescriptions will not result in presentable preparations without the advice of the trained pharmacist.

Needless to say, the pharmacist should not make any important changes in a prescription without having first secured the consent of the physician. However, the pharmacist should establish his professional standing in such a manner that the physicians will not only welcome his advice on prescriptions but will bring their prescription problems to him to secure an opinion.

Now that professors of pharmacy are teaching their students to coöperate with physicians it would be logical for the medical faculties to train the future physicians to consult the pharmacist on all pharmaceutical questions. Some medical colleges are handling this problem in a commendable manner but in others there is considerable room for improvement. For example, in some medical schools the subject of incompatibilities is scarcely mentioned in the courses in materia medica and prescription writing. One reason given for this is that the medical professor thinks the medical graduates would be afraid to formulate a prescription if they knew they might run into such a thing as an incompatibility. Such teaching is not fair to the medical student; he should be taught that incompatibilities are frequently encountered and that such difficulties can be avoided or corrected by consultation with the pharmacist, who is a specialist in the field of drugs.

In some medical schools great stress is placed on prescribing one drug at a time, thus avoiding all incompatibilities. Such a policy is of doubtful validity. Although the combination of twenty or thirty ingredients in a single prescription may be very undesirable, the insistence of some medical men on giving only one drug is a resurrected principle of homeopathy and is just another manifestation of poorly conceived therapeutic nihilism. It is very evident that in many cases more than one drug is needed to produce a number of medicinal effects which may be desired, or one drug may be used to antagonize an undesirable effect of another drug without hindering the effect which is wanted. In the two following prescriptions, selected at random, it is impossible to suppose that any single ingredient would meet the needs as well as the formulated prescriptions.

℞ Zinci Sulfatis	gr. i
Sol. Adrenalin	♏ vi
Sodia Chloride	gr. iiiss
Sol. Acidi Borici Sat.	℥ i
M. Sig. Two drops in eyes.	

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* Section on Practical Pharmacy and Dispensing, A. PH. A., New York meeting, 1937.

[1] Head Professor of Pharmacy, University of Florida.

℞	Tr. Opii Camph.	10
	Bism. Subgallate	30
	Tr. Catechu Co.	20
	Po. Acacia	8
	Syr. Auranti, *q. s.*	120
M. and *Sig.*	ʒi *q.* 3 h.	

Regardless of the soundness of such a policy, every physician is free to prescribe one drug at a time if he chooses to do so. However, many individual drugs would be very unpalatable unless prescribed with some flavored vehicle. If this is done the question of incompatibility between the drug and the vehicle arises. Fantus and Dyniewicz (1) have recently discussed the incompatibilities of certain vehicles. Syrup of cherry and syrup of raspberry are incompatible with salts of silver, mercury, lead and quinine, owing to the presence of benzoic acid in the syrup as a preservative; these syrups are incompatible with alkaline substances on account of the resulting precipitation and color change. Other examples could be cited but it is evident that incompatibilities cannot be avoided even in one-drug therapy.

Correction of Incompatibilities.—Although incompatibilities may be a bugbear to the physician they should not be viewed in this light by the pharmacist. To the pharmaceutically trained man, an incompatibility should be looked upon as a problem to be solved and an opportunity for service.

The prescriptions which follow represent incompatibilities and dispensing problems which have recently been subjected to study and experimentation.

PRESCRIPTION No. 1.

℞	Potassium Citrate	ʒ iiiss
	Spirit of Nitrous Ether	fʒ iv
	Simple Syrup	fʒ iv
	Water, *q. s.*	fʒ ii

Prescriptions of this type have frequently been cited in the literature as examples of incompatibility. There is a cloudiness on mixing and subsequent separation into an upper layer consisting chiefly of alcohol and a lower layer which is mostly an aqueous solution of potassium citrate. It has been reported (2) that with the addition of half a drachm of water the above prescription can be dispensed as a clear, uniform preparation. In the present study this was found to be true under ordinary conditions of filling.

PRESCRIPTION No. 2.

℞	Potassium Citrate	ʒ ii
	Spirit of Nitrous Ether	fʒ ss
	Syrup of Orange	fʒ ss
	Water, *q. s.*	fʒ ii

It has been stated (3) that in this prescription cloudiness and separation into layers can be prevented by replacing half of the water by glycerin. However, when this prescription was filled as written by students in the course in prescriptions at the University of Florida it was found that a clear solution with no layering was ob-

tained. Subsequent investigation showed that in mixing the ingredients in a graduate at room temperature as much as 3 drachms of potassium citrate consistently failed to cause separation into layers. However, the use of 3.25 drachms resulted in layering; this result is in accord with the findings in prescription No. 1, in which a slight dilution of the prescription containing 3.5 drachms of potassium citrate obviated the layering.

Further tests were carried out to determine the effect of glycerin, syrup of orange and temperature on the layering. Glycerin was found to be of no value in preventing layering, since replacement of half of the water by glycerin did not prevent separation when 3.25 drachms of potassium citrate was used. Syrup of orange increased the tendency toward separation; when the quantity of syrup of orange was doubled, layering was observed with as little as 2.5 drachms of potassium citrate, while a reduction of syrup of orange to three-fourths of the specified quantity resulted in a clear, uniform solution with as much as 3.5 drachms of potassium citrate. When the ingredients of prescription No. 2 were cooled to about seven degrees centigrade the resulting prescription was cloudy but there was no separation.

It was found that if the ingredients were mixed in a graduate a considerable proportion or perhaps almost all of the ethyl nitrite was forced out of solution and escaped as a gas. When the ingredients were mixed in a tightly closed container the ethyl nitrite proved to be a factor in the layering, since under these conditions 3 drachms of potassium citrate caused a layering which was not the case when the mixing was done in a graduate.

PRESCRIPTION NO. 3.

℞ Sodium Nitrite
Sodium Iodide, *aa* gr. iiss
Make 20 such capsules.
Sig. One three times a day as directed.

In a discussion of this prescription it was stated (4) that free iodine is liberated and that the two salts cannot be dispensed in the same capsule. In our consideration of this prescription the question arose as to whether or not the liberation of iodine was due to reaction between the two salts. In order to settle the question a number of tests were carried out. When the prescription was filled as written the capsules turned yellow, absorbed water and disintegrated within a few days. The addition of an equal quantity of starch prevented disintegration but the capsules showed spots of discoloration in a short time. Sodium iodide alone in capsules turned dark, absorbed water and dissolved the capsule with greater rapidity than when the prescription was filled as written. Sodium nitrite alone in capsules gave no sign of deterioration in several weeks. An aqueous solution containing 25 grains each of sodium iodide and sodium nitrite to the fluidounce had not changed color after several weeks. These results clearly show that the deterioration of the capsules is due to the deliquescence and decomposition of sodium iodide rather than to any reaction between sodium iodide and sodium nitrite. In acid solution, the well-known reaction between iodides and nitrites would occur but this does not take place in absence of excess hydrogen ions.

PRESCRIPTION NO. 4.

℞ Naphthaline	ʒ ii
Benzoic Acid	ʒ iii
Alcohol	ʒ ii
Dil. HCl, *q. s.*	ʒ iv

This prescription would not give a clear solution as written. However, by using some ether and more alcohol and replacing the diluted hydrochloric acid by an equivalent quantity of the concentrated acid, a clear solution was obtained. The procedure was as follows: Dissolve the naphthalene in one ounce of ether and add the benzoic acid dissolved in a portion of the alcohol; add alcohol to make three ounces; then add 25 cc. of concentrated hydrochloric acid and bring to volume with alcohol.

PRESCRIPTION NO. 5.

℞ Quinine Sulph.	30
Syr. Glycyrrhiza, *q. s.*	120
M. Sig. Teaspoonful as directed.	

When the patient shook the bottle and took out the cork a large portion of the medicine foamed out of the bottle. The foaming was caused by use of a fermented syrup by the pharmacist. When the prescription was refilled using a freshly prepared syrup and the patient instructed to keep the medicine in a refrigerator, there was no further difficulty.

PRESCRIPTION NO. 6.

℞ Potass. Brom.	15
Aq. Camph., *q. s.*	120
M. Sig. 8 cc. as directed.	

It was expected that this prescription would show precipitation of camphor but no precipitate was observed unless the camphor water was freshly made. Even then the precipitate was not appreciable but there was considerable precipitation if the proportion of potassium bromide was increased slightly. It would appear that camphor water loses an appreciable proportion of camphor under usual conditions of storage.

In connection with the three prescriptions which follow, the senior author sought the assistance and advice of his colleagues on the Committee on Pharmaceutical Dispensing[1] of the National Conference on Pharmaceutical Research and grateful acknowledgment is made of their interest and help.

PRESCRIPTION NO. 7.

℞ Liq. Pot. Arsenitis	ʒ i
F. E. Phytolaccæ	ʒ iii
F. E. Echinaceæ	ʒ iii
Syrup Ferri Iodidi	ʒ iii
Elixir I. Q. S., *q. s.*	ʒ iii
Sig. ʒi *T. I. D. A. C.*	

There are a number of possible incompatibilities in this prescription, the worst

[1] The personnel of this committee is as follows: W. J. Husa (chairman), I. A. Becker, W. Gray, S. L. Hilton, J. L. Lascoff, L. D. Bracken, L. A. Seltzer, H. A. Whitney.

being the heavy, gray, gelatinous precipitate formed on direct mixing of syrup of ferrous iodide and solution of potassium arsenite. However, the latter incompatibility may be avoided by mixing the syrup of ferrous iodide with part of the elixir and then adding successively the solution of potassium arsenite, the fluidextracts and the remainder of the elixir. This procedure gives a presentable mixture with no definite precipitate but only a slight turbidity which appears when the fluidextract of echinacea is added.

PRESCRIPTION NO. 8.

℞ Ichthyol		10%
Pulv. Boric Acid		ʒ ii
Pulv. Zinc Oxide		ʒ ii
Acid Carbolic		½ of 1%
Liquid Petrolatum		ʒ iv

M. Ft. sol.

The physician insisted that this prescription be filled as written. Since ichthyol does not mix very well with liquid petrolatum and the powders will settle to the bottom, it seems impossible to obtain a really smooth mixture unless the physician consents to some change. The simplest change would be to use petrolatum in place of liquid petrolatum (5). If a liquid is insisted on the ichthyol might be incorporated with an ounce of liquid petroxolin and combined with a mixture of another ounce of liquid petroxolin with the zinc oxide, boric acid and phenol, after which two ounces of liquid petrolatum would be incorporated (5). A product of very good appearance which shows no separation was made by mixing a solution of the ichthyol in a very small quantity of water with a solution of ten grains of stearic acid in a very small quantity of hot water and adding the remainder of the ingredients (6).

PRESCRIPTION NO. 9.

℞ Liquor Carb. Detergens		ʒ ss
Glycerin		ʒ ii
Spts. Vini Rect.		ʒ i
Amyli		
Zinc Oxide,	*aa*	ʒ iss
Aq. Calcis, *q. s.*	*ad*	ʒ vi

M. Sig. External use.

In prescriptions for lotions containing starch the question arises as to whether the physician wishes to have the starch suspended as such, so as to leave a powder on the skin when the vehicle evaporates, or whether he wishes to get a demulcent effect as might be obtained by boiling the starch with water. In connection with prescription No. 9, the opinion of leading dermatologists in various sections of the United States was secured. Most of the dermatologists were of the opinion that the purpose of the starch was not as a demulcent but as a powder on the skin after evaporation of the vehicle. However, some dermatologists held the opposite opinion and stated that it would be desirable to convert the starch to a mucilage or glycerite. In view of these conflicting opinions it is apparent that the best procedure is for the pharmacist to consult the physician and determine his exact intent. Some pharmacists avoid heat in all starch preparations unless it is specified. A good policy is for the physician to prescribe glycerite of starch when the demulcent effect is required.

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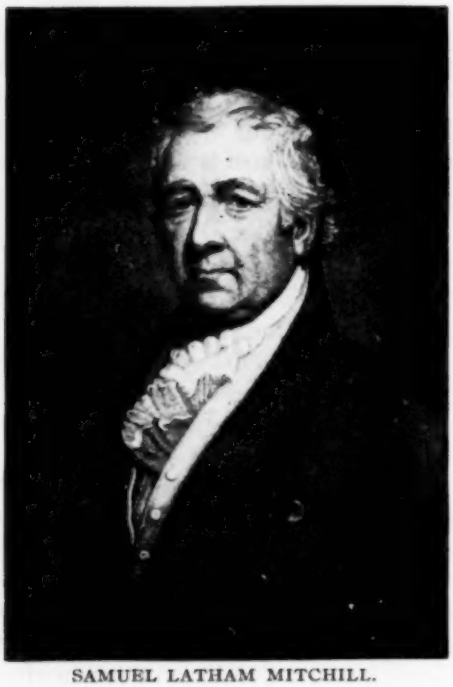
(5) Gray, W., Communication to senior author.
(6) Lascoff, J. L., Communication to senior author.

THE PRESIDENT OF THE FIRST CONVENTION, CALLED TO FORMULATE THE UNITED STATES PHARMACOPŒIA; SAMUEL LATHAM MITCHILL, AUGUST 20, 1764–SEPTEMBER 7, 1831; PHYSICIAN, CHEMIST, AUTHOR, SENATOR, REPRESENTATIVE AND PROMOTER OF THE SCIENCES.*

BY LYMAN F. KEBLER.[1]

Samuel Latham Mitchill is one of the most outstanding and influential, if not the most outstanding and influential person that ever occupied the presidency or any other position connected with any convention, or any other activity, dealing with the United States Pharmacopœia. I realize that this is a very broad statement but believe that what follows will fully substantiate the assertion. I have been rather surprised to find that so little is recorded in pharmaceutical literature and that so few persons in pharmacy, chemistry, botany or the cognate sciences seem to have the remotest knowledge of the activities of this super-man, in calling attention to the frauds and impositions practiced by drug dealers, in stimulating uniformity in the manufacture of medicines, in aiding unification in the writing of prescriptions and in taking a leading part in providing the early American drug standards. Even Professor LaWall does not refer to him in his comprehensive, "Four Thousand Years of Pharmacy." Brief references to certain of the above activities will be found in the "Life of Dr. Lyman Spalding," by his grandson, Dr. James A. Spalding, 1916.



SAMUEL LATHAM MITCHILL.

The part that Dr. Mitchill played in connection with the early pharmacopœial work in the United States, is briefly related in the 1820 or the first edition of the United States Pharmacopœia and much more briefly in the historical writeups

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* Section on Historical Pharmacy, A. PH. A., New York meeting, 1937.

[1] Former Chief Drug Division, Bureau of Chemistry, U. S. Department of Agriculture

of the later revisions of this authority. It is rather interesting to find that in the 1820 edition his name is uniformly spelled *Mitchell*. In a few other instances it is so spelled, but generally his name is spelled *Mitchill* and he so signed it. A goodly number of persons of note, antedating Dr. Mitchill, over a period of several centuries, spelled their name Mitchell, but no definite blood relation seems to be recorded. This also applies to the physician-chemist Dr. Thomas D. Mitchell, at times spelled Mitchill, author of a splendidly written American book, called, "Medical Chemistry," published in 1819, a year before the advent of the first United States Pharmacopœia. There is no question but that whatever spelling was used during the past century and a half in connection with the given name Samuel Latham, it had reference to Dr. Samuel Latham Mitchill.

THE EARLY LIFE, ENVIRONMENT AND EDUCATION OF DR. MITCHILL.

A number of eulogies and interesting biographical sketches (1) have been written about this remarkable man, but there is no real biography. One reason given is that a fire destroyed a vast amount of the material collected for such a biography. All of the eulogists and biographic sketchers have apparently overlooked one of the most important activities to which he turned his hand and helped to establish, an activity the importance of which has been accentuated with succeeding decades, namely, providing drug standards for the guidance of the medical and pharmaceutical professions and for the use of food and drug law enforcing officials.

In order that the readers may have available some of the events in the life, environment, character and early education of our hero, a brief summary thereof will be given here. He was born in North Hempstead, Long Island, near New York City, of Quaker parents, Robert and Mary Mitchill, the third son of a family of eight children, six sons and two daughters. He was ushered into the world during troublous times. British commercial legislation was digging a chasm between the Colonies and the mother country. The American Revolution, probably one of the greatest movements in human history, was brewing. The Navigation acts were annoying and largely flouted. The hated Stamp Act was proposed the same year that he was born and passed in 1765. This act aroused intense if not furious opposition, resulting in its repeal, to be followed later by the obnoxious Tea Act, insisted on by King George III, which act led to the Boston Tea Party, December 1773. The King became infuriated, had other obnoxious acts passed directed against the people of Massachusetts and sent an army to awe them, but they refused to be swayed from their course of action. It led to the battle of Lexington, 1775, the beginning of the American Revolution. Young Mitchill was then in his tenth year and seventeen at the end of the struggle in 1781. Apparently he did not take part in the conflict. In fact he had a frail constitution; a hemorrhagic tendency of the chest at seventeen. He adopted horseback riding for exercising and was fortunate in averting the pulmonary evil.

In educational matters Samuel was very fortunate. Any boy who is raised on a farm, managed by intelligent parents, unwittingly obtains an education that in some respects surpasses much book learning. He observes nature first hand, learns to recognize animals, plants and vegetation by actual contact. He learns the difference between weeds and useful plant life. There was no unemployment during the revolution. Everybody was required to do his bit, farmers in particular, and most of the colonists were farmers. Judging from Dr. Mitchill's interest in agriculture, botany and the other sciences in later years he profited greatly from his contact with farm life.

His maternal uncle, Samuel Latham, a medical practitioner of note, observing the industry, intelligence and keen mind of his nephew Samuel, took an unusual interest in him. In fact it is recorded that Dr. Latham had no children of his own and actually adopted Samuel. He was given an excellent classical education under the tutelage of one of the leading educators of the time. His medical education was begun under his uncle, Dr. Latham, and continued for three years under the eminent Dr. Samuel Bard, a teacher and medical practitioner, for a time the personal physician of General Washington, while the latter was maneuvering in New York City, during the revolution. In addition to the above early training and experience the embryo doctor

undoubtedly came into contact with some of the leading patriots of the time and absorbed some of their enthusiasm, determination and pluck for the cause of liberty. Among these worthy and revered souls may be mentioned Benjamin Franklin, General Washington, Thomas Jefferson, John Adams, John Hancock, Patrick Henry, Drs. Benjamin Rush, William Brown, Wm. Shippen, Jr., Andrew Craigie and others too numerous to mention.

EDUCATION AND EXPERIENCE ABROAD AND THE BEGINNING OF HIS PROFESSIONAL CAREER AT HOME.

Let us now note some of the influences under which he came and the events that transpired during his residence in the University of Edinburgh, acquiring his medical degree. His professional work in the University was started in 1783 and the medical degree conferred on him in 1786. It should be observed that the doctor spent at least six years of study in medicine to acquire his medical degree. That was one hundred and fifty years ago. He certainly should have been well equipped for his life work. The records show that he was well equipped. He was pleasant of personality, diplomatic, agreeable in manners and made many friends abroad, irrespective of the great discord just passed through between the colonies and Great Britain. He had the good fortune in the University of coming under the influence of such magnanimous teachers as Drs. William Cullen, Joseph Black, Andrew Duncan and Alexander Monro, who apparently took a special interest in their brilliant American pupil.

During his student days in Edinburgh the phlogiston theory of chemistry was in the death throes of disintegration. The work of the eminent French chemist, Antoine Laurent Lavoisier, based largely on the discoveries of other chemists, overthrew the nebulous theory of Becher and Stahl, about 1783. But Mitchill's brilliant teacher in chemistry, Joseph Black, did not see its undoing until 1791. He indoctrinated all of his pupils up to that time with the undefinable phlogiston theory. Moreover, two other noted English chemists of the time, Henry Cavendish and Joseph Priestley, who had a marked influence on the views of chemists, were purblind to the fall of phlogiston and the coming of modern chemistry. Notwithstanding the phlogiston permeated English atmosphere, in which Samuel Mitchill studied chemistry, he early became a disciple of Lavoisier and is credited with being the first to teach modern chemistry in the United States. More of the phlogiston agitation will come later.

Dr. Mitchill obtained general praise everywhere. He mingled freely with all classes. He was initiated into the unique and famous Latin Masonic Lodge of the Roman Eagle, while a student in the University of Edinburgh. On his return from Europe he was the lion of the day in medical, literary and fashionable circles. He obtained a license to practice medicine. A part of his spare time he devoted to the study of law and was admitted to the bar. Every moment he felt should be marked by some service to humanity. In 1788 he received an honorary A.M. degree from the Columbia University.

DEVOTING HIS ENERGIES TO THE PRACTICAL SIDE OF LIFE.

We now find Dr. Mitchill giving attention to the practical side of life. He analyzed the Saratoga Springs waters and enhanced their importance. In 1791 he became a member of the New York State Legislature and secretary of the Society for Promoting Agriculture, Art and Manufacturing. A year later he was appointed to the chair of Natural History, Chemistry and Agriculture at Columbia College. Here he soon taught the chemistry of Lavoisier. In 1801 he published a chemical tract on the "Chymical Nomenclature of Lavoisier." In 1807 he was chosen professor of chemistry in the newly organized New York College of Physicians and Surgeons. A year later he transferred to the chair of natural history, in which position he served until 1820, when he became professor of botany and materia medica. This position he resigned in 1826 and helped organize the Rutgers Medical College. He took great delight in the study of botany, which brought him close to nature. Dr. Mitchill was a wonderfully brilliant and successful teacher. None left his lectures empty handed. He is credited as one of the most gifted and versatile men New York State produced. Dr. Edgar F. Smith, himself a former great teacher and chemist, pays him this tribute, "Dr. Samuel L. Mitchill, whose depth and breadth of learning astonished the world."

As previously noted, Dr. Mitchill served in the New York Legislature as early as 1791.

He was then 27 years of age. Ten years later he accepted a seat in the United States House of Representatives, served as such from 1801 to 1804; served as United States Senator from 1804 to 1809; then again as a Representative from 1810 to 1813. Being a prodigious worker, unusually well informed and versatile, possessed of a remarkable memory and a polished speaker, he soon became a leader in Congress, as elsewhere. The State and National records (2) must be consulted to obtain any idea as to his activities for the general good as a public servant. Members of Congress called him the "Congressional Library," for which he labored valiantly. Others called him a "Living Encyclopedia and a chaos of knowledge." The nature of some of his labors will be found in the letters he wrote his wife from Washington, and published in *Harper's Magazine*, April 1879, nearly fifty years after passing to his reward. The prelude to the above letters is one of the most masterful and laudatory of any person, that it has been my privilege to read.

Dr. Mitchill was one of the three early physician-chemists who entered the legistative halls in America. Dr. Benjamin Rush, late in life, became a member of the Continental Congress and assumed the burdens of the times. Next came Dr. Mitchill. Dr. Adam Seybert was the third. The latter two were members of the 11th and 12th Congresses: members when war was declared on England in 1812; members when the duties on imports were doubled to raise revenues to help pay the expenses of the war. These two physician-chemists had more in common than the average Congressmen and they worked for the same objectives. They were probably instrumental in having Congress pass the act, in 1813, encouraging vaccination for smallpox (3). The thinking men of the Republic looked with great favor on both of them. They reflected great credit on their consituents and country.

THE MEDICAL REPOSITORY. THE FIRST MEDICAL SCIENTIFIC JOURNAL IN THE UNITED STATES.

Dr. Mitchill, with Drs. Edward Miller and Elihu H. Smith, established the *Medical Repository* in 1797, of which he was the principal editor for 23 years. It is considered the earliest medical scientific journal published in the United States. As a money maker it, like other scientific publications, was not a success, but it is replete with many early interesting scientific observations. In fact it is the only publication in which can be found some of the chemical and medical activities of the times. It is in this journal in which Dr. Mitchill published his observation on the frauds and impositions resorted to by drug purveyors. It was through this journal that correspondence was started in 1798, between Drs. Mitchill and Lyman Spalding, that resulted in a warm friendship throughout the life of the latter. It was in the early volumes of this journal that Dr. Joseph Priestley's last stand for phlogiston and the resulting controversies are recorded (4). The differences between Dr. Priestley and the American chemists at times became acrimonious. The chemists participating were John Maclean of Princeton, James Woodhouse of Pennsylvania and Samuel L. Mitchill of Columbia. Minister Plenipotentiary of the French Republic to the United States, P. A. Adet, also took part. Priestley himself started the phlogiston dispute on the American soil, by issuing a pamphlet entitled, "Consideration on the Doctrine of Phlogiston and the Decomposition of Water." Dr. Mitchill with rare acumen succeeded in keeping the belligerents within bounds. The surperb manner in which he handled the contending parties shows how an acute discussion on the sciences may be conducted. But Dr. Priestley remained a staunch phlogistonist to the end of his days.

In volume 20, page 329 (1820), will be found a writeup of the 1820 Pharmacopœial Convention and in volume 21, page 427 (1821), appears a very excellent review of the 1820 United States Pharmacopœia. In fact this is the only worth-while review at the time I have been able to find of this era-making book of the medical and pharmaceutical professions. The writer of the review is not given. It was probably Dr. Felix Pascalis, one of the editors.

HOSPITAL EXPERIENCE, PRESCRIPTION WRITING AND PHARMACOPŒIAL WORK.

Dr. Mitchill became physician to the New York Hospital in 1796 and served in this capacity for twenty years. He was acknowledged a sound physician at the bedside. He certainly possessed all of the qualities requisite for such work, a devout humanitarian, a patient, tireless worker and a brilliant impressive teacher. The simplicity of his prescriptions often provoked a smile on the part of his students. Shot-gun prescriptions were then in vogue. Many of them were the products of inadequate information regarding the therapeutic action of the various drugs.

Many persons practicing medicine lacked proper medical training formerly, then and years later. This was pathetically brought out during the Revolutionary War. Some of the physicians commissioned were never educated into the medical profession. General Washington characterized them as "A disgrace to the profession, the army and society." Here is what the General had in mind when he spoke so feelingly. Dr. Blank, a surgeon during a part of the revolution, was not educated into the medical profession, while he thus served. He obtained a medical degree in Edinburgh in 1786, five years after the war. It is true a number of creditable medical schools were functioning by the end of the eighteenth century and more physicians obtained their training abroad but the conditions in the practice of medicine had not improved materially over those obtaining during the revolution.

The requirements for the practice of medicine were still meagre. Dr. Spalding made inquiry of Dr. Mitchill regarding the necessary qualifications for New York. Dr. Mitchill, 1799, (5) wrote: "There is an Act of the Legislature relative to the practice of Physick and Surgery, but it is a poor stupid thing, and I believe few pay any attention to it. Two years' previous study with any practitioner and no examination required. If a person has been a student the requisite time, he will get a certificate from his master, and file it in the office of the County Clerk, and then he is a Practitioner. When I last attended the Legislature, I endeavored to obtain the repeal of a Statute which seemed to me rediculous, and disgraceful to the Profession, but I did not succeed."

There were no books on the practice of American Medicine. To bridge this chasm physicians intercommunicated their cases with one another by word of mouth and at medical meetings. Some were published in detail in the *Medical Repository*, and others elsewhere. The Massachusetts Medical Society, in 1785, divided the Commonwealth into four districts (6) the Eastern, Western, Southern and the Middle, to encourage the reporting of medical cases.

Numerous pharmacopœias, dispensatories, formularies and medical chemistries were published in various European countries, during the sixteenth, seventeenth and eighteenth centuries. It seems that to the publishing of these kinds of books there was no end. Some of them were brought in to the colonies by the immigrants. Others were imported. They were employed by physicians, pharmacists and even the layman for the manufacture and use of medicines. There was manifestly no uniformity in the finished products. They of necessity varied with the directions prescribed by the various authors and the quality and purity of the drugs used. The case of a layman may be cited. William Penn, in 1682, brought with him, for his use and those with him an English translation of the excellent work by Johann Schroeder, entitled, "A Compleate Chymical Dispensatory in Five Books." With the advent of the Revolution the supply of imported drugs was largely restricted.

These conditions undoubtedly materially disturbed the Surgeon General and the Apothecary General of the Continental Army and those associated with them. A Government pharmaceutical laboratory, for preparing and compounding medicines, was established in the Pennsylvania Hospital in Philadelphia. This laboratory undoubtedly met some of the difficulties encountered. In 1778, was published the first American Pharmacopœia, also called a Military Pharmacopœia. No author was given. It probably was the joint product of the physicians and apothecaries enlisted in the Continental Army. A reprint appeared in 1781, under the name of Dr. William Brown, who was no longer connected with the army. It is essentially a book of prescriptions. This Pharmacopœia passed out of the picture. It apparently did not fill a general need.

AMERICAN ACTIVITIES PRESAGING A NATIONAL PHARMACOPŒIA.

Dr. Benjamin Smith Barton, before the Philadelphia Medical Society, February 21, 1798, and in 1804, in discussing certain drugs said (7): "They should have a place in the Pharmacopœia of this Country, when such a desideratum shall be supplied." A dispensatory, each, was published by Dr. John R. Coxe in 1806, and Dr. James Thatcher in 1810. At a meeting of the Massachusetts Medical Society, in 1786, the purity of drugs (6) was taken up with the view of considering the desirability of addressing the Legislature regarding some action that might be taken to prevent the sale of bad and adulterated drugs. This is the earliest consideration given the subject by a medical society in the United States. Action was delegated to the Council of the Society. Nothing further seems to have developed for nearly twenty years. In 1805 the Counselors of the Society appointed a Committee, consisting of Drs. James Jackson and John C.

Warren, to draft a Pharmacopœia adapted to the special needs of their section of the country. Efforts were made to secure the coöperation of other medical bodies in the United States without success. The Committee made its report in 1807. The Pharmacopœia of the Massachusetts Medical Society, based thereon, was published a year later. This Pharmacopœia, an excellent work, was founded largely on the latest edition of the Edinburgh Pharmacopœia.

The next movement to provide a pharmacopœia, was initiated at a meeting of the physicians and surgeons of the New York Hospital, April 4, 1815. A Committee consisting of Drs. Samuel L. Mitchill and Valentine Seaman was appointed to prepare and submit a draft. A draft was submitted October 7, 1815, examined by the Hospital Staff, somewhat amended and unanimously adopted. The Committee was directed to proceed with its publication. The book appeared in 1816 (8). This Pharmacopœia served as more than a local authority for a goodly number of years. The object of this publication was to bring about more uniformity in the quality, manufacture and prescribing of medicines. Physicians connected with the hospital, the consultants and visiting physicians, were prescribing medicines under the same or different names, that varied in character, strength and purity, depending on the formulas used in their manufacture, to the detriment of their patients, the physicians themselves and the pharmacists. English patent medicines were rapidly gaining a footing. These irregularities, variations and uncertainties were keenly felt by all concerned. The objectives were certainly laudable.

This Hospital Pharmacopœia embodies the drugs and prescriptions generally used by the above physicians and acceptable ones contained in the Pharmacopœias of London, Edinburgh and Dublin. It contains an alphabetically arranged materia medica, tables of weights and measures, signs used in prescribing, dosages, synonyms, modern chemical nomenclature, directions for manufacturing and preserving drugs and several kinds of diet, characterized as spare, common and full. There are no specific tests prescribed for determining the quality, purity or strength of the drugs used in the manufacturing operations or the finished products, excepting those inherent to the formulas themselves. It may be noted that the symbols used in prescription writing are generally employed in the directions for manufacturing medicines. More will appear about this later.

Dr. Lyman Spalding was born, bred, reared and largely educated in New Hampshire, where he established a medical practice. But he was anxious to try his hand in a large city. Dr. Mitchill on learning that his friend was desirous of engaging in practice in New York City gave him every possible advice, help and encouragement. This meant much to the younger physician. In 1813 he settled in New York City and soon built up a living practice. Dr. Mitchill helped him in making acquaintances, both professional and lay. Early in January 1817, Dr. Spalding read a paper before the New York County Medical Society (9), setting forth the needs of a National Pharmacopœia. He enumerated essentially the reasons that appeared in the New York Hospital Pharmacopœia, for its establishment. At the conclusion of the paper a committee was appointed, consisting of Dr. Spalding and some of his personal medical friends. Dr. Mitchill is first mentioned among the members by Dr. James Alfred Spalding in his "Life of Dr. Lyman Spalding." These two physician-chemists certainly worked in close harmony. Of the many duties that pressed themselves on Dr. Mitchill, he apparently was mindful of them all. In 1818 he accepted the additional duty of Surgeon General of the New York Militia.

ASSEMBLING OF DELEGATES AND CONSUMMATION OF THE UNITED STATES PHARMACOPŒIA.

The delegates of the Middle District met in Philadelphia June 1, 1819. Among them were Drs. Mitchill and Spalding and three other physician-chemists, namely, Elisha De Butts of Baltimore, Wm. MacNeven of New York and Joseph Parrish of Philadelphia. These delegates remained in session for five days and evenings, and prepared a rough draft of a proposed pharmacopœia. It must be said that this represented a vast devotion to the cause. The rough draft was sent to the Pharmacopœial Convention in Washington. A second draft was prepared by the delegates of the Northern District, who met in Boston, and likewise sent to Washington.

Six of the delegates to the first National Pharmacopœial Convention, met in the United States Chamber in Washington, Saturday, January 1, 1820, received, examined and discussed the two rough drafts submitted for a pharmacopœia. They adjourned late in the day to meet the following Monday, when five additional delegates made their appearance, among them Dr. Mitchill and two Physician Congressmen, namely, Joel Abbott and Wm. Terrel, both Representatives of Georgia. These eleven delegates spent the entire week, discussing, revising and comparing notes

on the material furnished them by the two rough drafts for a National Pharmacopœia. These eleven delegates decided on the United States Pharmacopœia and its future. Dr. Mitchill was elected President of the Convention and Dr. Spalding Chairman of the Committee of Preparation and Publication, which consisted of six members, including Dr. Mitchill as an *ex-officio* member. This committee met in New York, New Haven, Hartford and Boston. As far as the information available shows Dr. Mitchill attended all of them, excepting one in New York, when he was on duty in West Point, as a visitor appointed to the United States Military Academy by the War Department. But he wrote Dr. Spalding from West Point, sending his regrets and explaining his enforced absence. Here is a bit of humor he injected to soften the hard spots: "My function as a military man might be considered as very different from that of a medical man in our College, was there not, as the wags remark, something 'killing' in both professions."

The first edition of the United States Pharmacopœia was copyrighted December 15, 1820, in the 45th year of the independence of the United States, in the District of Massachusetts. This is the date given of its publication. In the field here under consideration, as much, if not more than in any other, progress is predicated on past performances. The vast amount of work given to the preparation of the 1820 Pharmacopœia is reflected by the improvements made in various lines. It was printed in Latin and English, on opposite pages. The handiwork of the New York Hospital Pharmacopœia is reflected on many pages and in many formulas, which one would naturally expect, from the nature of the work and with Dr. Mitchill a guiding spirit in both of them. Here are a few examples:

THE NEW YORK HOSPITAL PHARMACOPŒIA.

TINCTURA OPII.

Tincture of Opium.

℞	Hard opium powdered	℥ij
	Proof spirit	Oij

Digest seven days, and filter.

ARGENTUM NITRATUM.

Lunar Caustic.

℞	Silver	ʒj
	Nitric acid	fʒ i ss
	Distilled water	fʒ ij

Mix the nitric acid with the water, and dissolve the silver in it by means of a sand bath; then increase the heat gradually that the nitrate of silver may be dried. Melt this on a gentle fire until the water being driven off, the ebullition ceases; then pour it immediately into proper molds or iron pipes warmed and greased with suet. Lastly, put it up in a glass phial well stoppered.

THE 1820 UNITED STATES PHARMACOPŒIA.

TINCTURE OF OPIUM.

Called Laudanum.

Take of Opium powdered, two ounces.
Diluted alcohol, two pints.
Digest for ten days, and filter.

NITRATE OF SILVER.

Formerly Lunar Caustic.

Take Pure silver, flattened into plates, and cut into pieces, one ounce.
Nitric acid, one fluidounce.
Distilled water, two fluidounces.

Mix the nitric acid and water, and dissolve the silver therein on a sand bath; then increase the heat gradually that the nitrate of silver may be dried. Melt the salt in a crucible over a slow fire, until the water being evaporated, it ceases to boil and the mass flows like oil; then pour it quickly into molds of convenient shape. Lastly, keep it in a glass vessel very well stoppered, and secured from light.

The symbol ℞ is retained in the 1820 Latin directions for manufacturing. The materia medica is divided into two parts, Primary and Secondary. Chemicals are well represented. This is to be expected. Chemistry had been forging ahead very rapidly and there were three physician-chemists, including Dr. Mitchill, *ex-officio*, on the Committee on Preparation and Publication. A large number of plant products was also included. No dosages were provided. Specific gravities are prescribed for alcohol, hydrochloric, nitric and sulfuric acids. No other tests are required for determining the character, quality or purity of the crude drugs or finished medicines, excepting as may be ascertained from the authorities referred to in the text in the case of crude plant drugs and certain preparations thereof. The two physicians connected with the preparation of the pharmacopœia and best qualified in medical botany were Drs. Jacob Bigelow and Samuel L. Mitchill.

RECEPTION OF THE FIRST EDITION OF THE UNITED STATES PHARMACOPŒIA, SOME SUBSEQUENT EVENTS CONNECTED THEREWITH AND ITS REVISION IN 1830.

That the publication was as well received as anticipated is shown by the fact that a reprint was issued in 1828. The *Medical Repository*, referred to (page 911), printed a twelve-page review, setting forth its value to physicians and apothecaries. Physicians generally testified to its merits. The Surgeon General of the United States Army, Joseph Lovell, purchased seventy copies. It did not, however, fare so well in the Navy Department. The Secretary, Hon. Smith Thompson, on June 27, 1821, regretfully wrote Dr. Mitchill and as a part thereof sent a copy of a report of Doctor Edward Cutbush, Senior Surgeon of the Navy, which reads in part (10): "I regret that I cannot give it (The American Pharmacopœia) my unqualified approbation of the work for the use of our Naval Surgeons. It contains many prescriptions which every physician ought to be capable of forming according to the age of his patient, and the effect he wishes to produce.

"I consider the Articles composing the Materia Medica as the tools or implements of the physician, which he is to use according to the extent of his knowledge of their virtues, guided by his medical education and experience. I have no hesitation in declaring that many of the formulæ are injudicious and others *deficient* in the important articles which render them useful, and will be so considered by many of our profession, in short, Sir, I fear the work will not bear a critical examination. Such an *order* (for the American Pharmacopœia) would probably be considered as a sanction of the work in a National Point of View."

Dr. Cutbush certainly had a right to his views, but judged by one who has had many years of Government work, along the above lines, it appears supercilious and far from making for uniformity in medicines and prescribing.

About the time the Pharmacopœia came from the press Dr. Spalding received a severe blow on his head, from a falling box of rubbish, from which he never completely recovered. In fact it was a potent factor in his death. He passed to his reward October 21, 1821. In his death Dr. Mitchill lost a devoted, life-long personal friend and his Chariman of the Committee on the Preparation and Publication of the Pharmacopœia. An obituary (11) of Dr. Spalding, unsigned, but probably written by Dr. Mitchill, reads in part: "It is with unfeigned regret that we announce the death of a worthy man and enlightened physician. He was the original projector of our National Pharmacopœia, and aided with unremitting diligence in bringing the work to its present form, but an enfeebled and shattered mind induced by chronic disease, deprived him of the cheering view of the full consummation of his labors, and the profession of one of its most worthy members."

Dr. Mitchill felt the loss grievously. He continued with his educational work but his devoted and enthusiastic pharmacopœial worker was gone. When the request came for additional copies of the 1820 Pharmacopœia, Dr. Mitchill of course felt it his duty to act. In 1828 a reprint of the original was issued. In the copyright, registered December 23, 1828, appears the following: "The Pharmacopœia of the United States of America. By the authority of the Medical Societies and Colleges. Second Edition."

It was erroneously called a "Second Edition." I looked for additional information regarding this printing but found none.

About the time the second print of the 1820 Pharmacopœia was copyrighted, the various organizations interested in its revision were either planning to ballot or had sent the results of their balloting to Dr. Mitchill, who on April 1, 1829, was required to review the ballots received and make known the results thereof. This duty he faithfully performed. But the outcome was not entirely satisfactory. In some quarters dissatisfaction developed as to the election of some of the delegates. The blame was in part put on Dr. Mitchill. This seems strange, because the Doctor was tactful and adroit in all of his dealings; a diplomat of rare ability. As one views the situation one hundred years later, it was more probably due to friction and discord in the medical ranks in the Middle District, and more particularly those in New York City and Philadelphia. This view is fortified by the fact that no Philadelphia delegates attended the 1830 Convention in New York and no New York delegates are recorded as attending the 1830 Convention in Washington. And no New York delegates attended the 1840 convention, nearly a decade after Dr. Mitchill's death. Dr. Mitchill is credited as having issued the writs resulting in the election of the delegates to the Washington Convention. At the New York Convention all four of the Districts

were represented, while in the Washington Convention all of the regular delegates came from the States South of New York and North of the Potomac River. Of the three physicians in Congress, voted as members by the Washington Convention, one came from Kentucky, another came from Maryland and the third came from New Jersey. Let us now draw the curtain on this disharmony. In fact had it not involved the hero of our story it would never have been lifted on the scene.

COMMENTS ON THE TWO 1830 REVISIONS OF THE 1820 UNITED STATES PHARMACOPŒIA.

For convenience they will be called the New York and Washington revisions, respectively. The New York revision was copyrighted July 29, 1830, less than two months after the delegates met for its active revision, June 2, 1830. The revision was evidently made largely by the assembled delegates, at the time. There apparently was no special revision committee. Most of the delegates were teachers of materia medica and two included physic. One delegate, Dr. John A. Smith, was a physiologist. The Materia Medica portion embodies much valuable information, not contained in its predecessor. As examples let me quote several monographs, then call attention to some of the valuable added features.

ACIDUM NITRICUM. Acidum Nitricum.

Nitric Acid. Aqua Fortis.

Prop. Liquid, colorless, transparent, fuming; taste extremely acid and caustic; odor stifling; highly corrosive, turning the skin indelibly yellow; a fluidounce should decompose an ounce of carbonate of lime.
Med. Oper. Tonic, alternative, antiseptic, escharotic. Dose, ♏ X. to ♏ XX.
Prop. means properties. Med. Oper. means medicinal operations.

ASSAFŒTIDAE GUMMI RESINA. Ferula Assafœtida.

Assafœtida. Gum-resin.

Prop. In small irregular masses, adhering together, filled with small shining tears of a whitish, reddish or violet hue; odor fœtid and alliaceous; taste bitter and sub-acrid; soluble in alcohol and ether; forms an emulsion with water.
Med. Oper. Stimulant, anti-spasmodic, expectorant, anthelmintic. Dose grs. V. to ℈I.

CUPRI SULPHAS. Cupri Bi-Per-Sulphas.

Sulphate of Copper. Blue Vitriol.

Prop. Crystals rhomboidal prisms, rich blue, slightly efflorescent; inodorous: taste harsh, acrid, styptic; soluble in four parts of water at 60°, and in less than two at 212°.
Med. Oper. Tonic, emetic, astringent, escarotic. Dose, as an emetic, grs. II to grs. XV; tonic, gr. 1/4.

Plant and animal products are rather fully described. Indeed too fully to quote here. Three kinds of cinchona barks are recognized. Their physical properties are clearly outlined and certain of their active principles are given. Yellow Cinchona Bark, active principle, Quinia. Pale Cinchona Bark, active principle, Cinchonia. Red Cinchona Bark, active principles, Quinia and Cinchonia. Turkish and East Indian Opium are well described and their chief alkaline substances, Morphine and Narcotine, given.

It is interesting to observe that the alkaloids quinine and cinchonine were discovered only ten years previously, while narcotine was isolated in 1803 and morphine in 1805. The commercial manufacture of quinine sulfate, in the United States, was started in 1823, and morphine and its salts in 1832.

The above certainly shows marked advancements over its predecessor, particularly in the realm of botany and chemistry. In the field of botany the leader undoubtedly was Dr. Jacob Bigelow of Boston but Dr. Mitchill was an active supporter. In the field of chemistry Dr. Mitchill stood supreme. In truth he has been declared to be the best informed and most versatile man of

science in the world of his time. I may further say that Dr. Mitchill during the course of his life became an active member of nearly all of the learned societies of the world; that his diplomas and scientific distinctions, it is alleged, might have required a team to carry away, but that in spite of all of his honors and scientific testimonials, he was accessible to everybody, young and old, at all times. There seems to be little doubt but that Dr. Mitchill must be given credit for the major part of the chemical advances introduced into the New York revision. Regarding the therapeutic advances introduced, no single delegate seems to stand out. Each one undoubtedly contributed his modicum. I cannot refrain from expressing the opinion that had proportionate advances been made in the 1840 revision, which became a standard under the 1848 drug import law, over this immediate predecessor, as the New York revision made over the 1820 United States Pharmacopœia, there would not have developed the hectic conditions that resulted from the efforts made to control the importations of spurious, inferior and adulterated drugs, under that law.

The New York revision was rather harsbly criticized (12) during the course of a review. The reviewer expressed the view that severe criticism may be indulged in, in an examination of a pharmacopœia. Said he: "Not an error in a letter or a figure should be suffered to escape correction." This is indeed ideal, but during more than forty-five years of intimate contact with pharmacopœias, I have yet to meet with this ideal. The reviewer alleged that it contains gross typographical blunders; that it is too precise in some instances; that the descriptions of the properties and qualities of the drugs are too short to be of any value to the apothecary; that it inexcusably omits giving processes for obtaining the alkaline principles quinia, morphia and strychnia, processes that are described in all modern treatises on the subject; that it does avoid the gross and careless blunders that marked the 1820 Pharmacopœia throughout, due to undue haste in its preparation. This is a rather belated criticism of the 1820 edition. Dr. Mitchill, president of the 1820 Pharmacopœial Convention and the presiding officer of the 1830 Convention, seldom made any retorts to attacks involving his activities. He let his acts and works speak for themselves; no vindication needed.

The Washington 1830 pharmacopœial revision was copyrighted in 1831, in the Eastern District of Pennsylvania. It follows closely along the lines of the 1820 pharmacopœia. A new feature is methods for the manufacture of quinine sulfate, morphine, morphine acetate and morphine sulfate. Is it to be presumed that the apothecaries of a century ago were so well trained that they could execute the difficult task of manufacturing the above alkaloidal preparations? It may be said without fear of contradiction, that there are few if any retail pharmacists, for whom the Pharmacopœia was formerly intended as a guide in manufacturing, of our time, who are qualified to execute their manufacture, economically. One is bold enough to ask whether any member of the Washington 1830 Revision Committee was qualified to make these alkaloidal preparations by the methods given? It is very doubtful.

The question that would naturally arise in the minds of physicians, pharmacists, authors of materia medicas, dispensatories, etc., which of the two 1830 revisions is official, if either of them? This problem perplexed Dr. John Redman Coxe not a little, when he undertook the revision of his American Dispensatory, as is clearly shown in the preface of the 8th edition, published in 1831. The doctor uses antimony wine as an illustration to show how they differ. The New York revision directs the use of four grains of tartar emetic to the ounce of wine, the same as required by the 1820 edition, but the Washington, or the Philadelphia 1830 revision, as he chooses to call it, prescribes two grains to the ounce. He feels that these two 1830 revisions have done and will do much to disrupt the uniform system of standard prescriptions, initiated by the first or 1920 United States Pharmacopœia. In this he is on firm ground. Dr. Mitchill who had just passed on, is favorably referred to several times. Dr. Coxe considered the New York 1830 revision the superior for various reasons. The views expressed by Dr. Coxe were caustically assailed (13) by Dr. George B. Wood, a fellow townsman and a delegate to the Washington 1830 Convention. Any reader who may be interested in pursuing these distasteful, unfortunate episodes any further is kindly referred to the originals.

Now ends the story of one of the important activities of a wonderful man whose life it has been a great privilege and pleasure for me to study. In conclusion I desire to thank the staff of the Surgeon General's Library, the Department of Agriculture Library force and E. G. Eberle, for the many kindnesses rendered me in this and other investigations.

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(13) *Ibid.*, 4, 94 (1833).

EARLY AMERICAN PHARMACEUTICAL INVENTIONS.*

BY CHARLES WHITEBREAD.[1]

Until a few years ago a person applying for a United States patent was required to supply a model of his invention to the Patent Office, United States Department of Commerce. These models were kept by the Patent Office and an immense number of them accumulated. When it eventually became necessary to change the phase of office procedure requiring the submission of a model with the application for a patent, there was substituted for the previous method a plan under which drawings took the place of the models.

The large collection of patent models which had accumulated through the years, and which represented practically every branch of industry, was then disposed of in various ways. Some of the models were returned to patentees or their descendants, others were transferred to the Smithsonian Institution to be exhibited in the United States National Museum and others were junked.

The patent models which reached the Division of Medicine included inventions classified under the headings of medicine, surgery, dentistry, pharmacy and nursing. All of these inventions were devised with a view to simplifying the practice of medicine. Consideration is given to a few unusual patent models of general medical interest and, in more detail, the patent models devised for use in the practice of pharmacy.

When the anesthetizing power of ether became known, physicians were confronted with the work of placing patients under its influence, a new task and one involving painstaking care and responsibility. What was more natural than to

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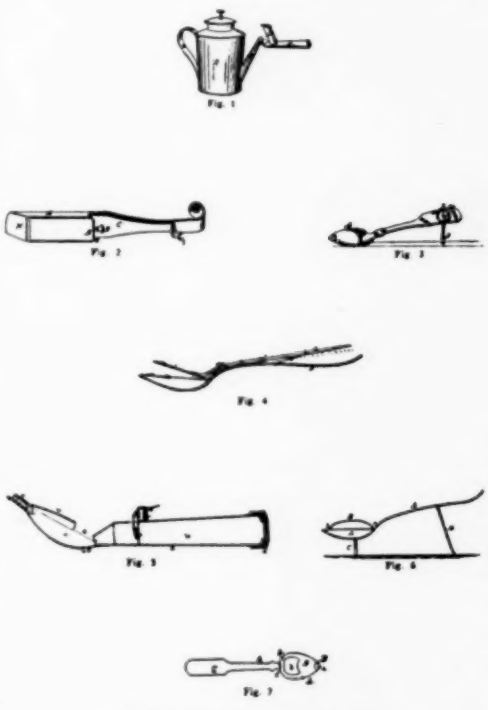
[1] Assistant Curator, Division of Medicine, United States National Museum.

desire a device which would simplify the task and make it as nearly foolproof as possible? So Dr. W. T. G. Morton, with the help of an associate named Gould, invented and patented an ether inhaler. It will be remembered that Dr. Morton was the dentist and physician who first demonstrated practical ether anesthesia to the world. This Morton and Gould inhaler, a sort of tin can apparatus with a mouthpiece, was among the models turned over to the Division of Medicine. Of course, the inhaler never came into general use, the method of dropping ether on cotton being more simple.

In the surgical collection of models are many devised to simplify the operation of bloodletting which was so much in vogue in the early history of the United States. Some of these old surgical instruments are vicious and wicked-looking contrivances. One resembles a revolver, and has the tip of a knife protruding from the end of the barrel. This instrument is operated by pulling back the hammer of the revolver, thus drawing the point of the knife blade back into the barrel against a strong spiral spring. The end of the barrel is now placed on the vein to be punctured, after which pressure on the trigger causes the knife to shoot forward making the necessary incision for the application of an "exhausted cup."



Nursing Patent Models.
Fig. 1.—Pill administrator; Figs. 2–7, medicine spoons.—*Courtesy of U. S. National Museum.*

The instruments represented in the collection of dental patent models are very unusual, many of them being quite unlike the working tools of a dentist of the present time. For instance, a drill in the collection is operated like a spray gun with a back and forth movement of the handle to drive a wheel and chain which rotates the drill. Another drill is spun by a spring, and the device, which is shaped like a bellows, has to be wound up like a clock.

Inventors have appreciated the tedious work of nurses, and have invented all sorts of medicine spoons, some with covers to protect medicines and mustaches, some with feet so a filled spoon will be at the patient's hand for self-administration and others with a clock-like dial on the handle to serve as a reminder when to give the next dose of medicine. One of the most unusual of the nursing patent models is a device for the administration of pills without the knowledge of the patient.

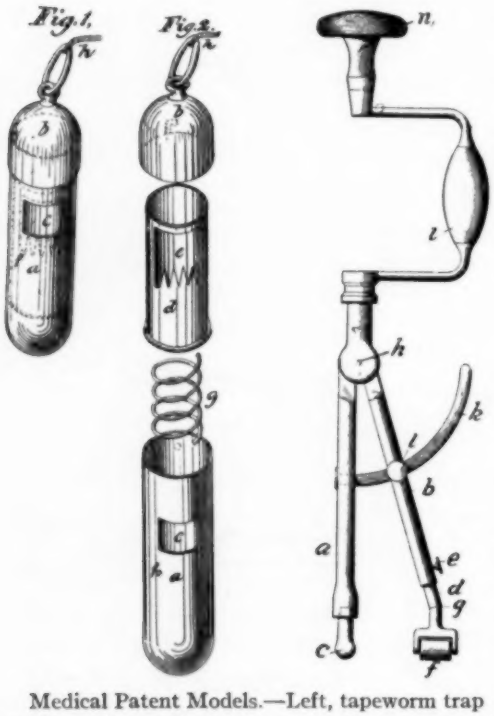
This device resembles an ordinary teapot and has an opening in the long crooked spout into which the pill may be dropped surreptitiously by the nurse when the patient is drinking from the spout.

A famous invention represented in the national collection is a set of the metallic tractors patented in 1796 by Dr. Elisha Perkins, a Connecticut physician.[1] The tractors, which came in pairs, resemble horseshoe nails.

One is made of brass and the other of steel. They are applied by drawing the points over the affected parts for about twenty minutes at a sitting. The tractors' curative properties were believed to be due to magnetism or electricity supposed to be generated by them.

In passing judgment on this patent it should be remembered that it was granted when knowledge of electricity was more limited than at present, and investigators were proclaiming galvanic electricity—discovered only five years earlier by Galvani—as a specific for all kinds of disorders.

One of the most unique of the medical inventions is the Myers' Tapeworm Trap, patented in 1854 by Dr. Alpheus Myers.



Medical Patent Models.—Left, tapeworm trap ready to be swallowed; center, the tapeworm trap (enlarged), separated in its component parts; and right, the dimple-producing instrument.—*Courtesy of U. S. National Museum.*

The trap, which is made of metal, resembles a large capsule such as is used in administering powders. The lower half of the capsule has in its side a rectangular window, and also contains a snugly fitting cylinder. This cylinder also has a window (with lower rim sharply toothed), the lower edge of which rests on a spiral spring. In use, the trap is baited with a suitable nutritious substance, and the cylinder with the tooth-edged window is forced down on the spring until the teeth are below the window opening where it is held by a small stud. The trap is now ready for use. The tapeworm's host is instructed to fast for a suitable length of time before swallowing the trap, the idea being to have the parasite so hungry that it will be quickly attracted to the bait. The trap is then swallowed, a safe grip being kept on the cord attached to the upper half of the capsule. The tapeworm is supposed to put its head into the little window to remove the bait. This tampering with the bait releases the cylinder which is forced upward by the spring, and the tapeworm is snared. The release of the cylinder is supposed to warn the patient so he can pull on the string and bring the trap and the captured tapeworm to the exterior.

In February 1877, a patent was granted for a "Pedal Calorificator," an improvement in foot warmers.

The invention is quite a simple one, consisting of a cup-shaped mouthpiece from which are suspended two tubes each long enough to reach from the mouth of the user to his feet. In the operation of the apparatus, the sufferer from cold feet is instructed to inhale through his nostrils and to exhale into the mouthpiece thus sending his hot breath down to warm his feet.

[1] Illustration of these famous instruments, JOUR. A. PH. A., Vol. 22, No. 11, page 1142 (Nov. 1933).

"A device which serves either to produce dimples on the human body or to nurture and maintain dimples already existing," was patented in the United States in 1896, by a resident of Berlin.

This invention looks like a carpenter's brace and bit, the bit being a small rounded knob. An adjustable extra arm also extends from the brace, and it has on its lower extremity a small rotating roller. In use, the knob-like bit is placed on the spot where it is desired to form a dimple, or where one already existing is to be accentuated, and the brace is then turned on its axis. The rotating knob is supposed to make a dimple, and the roller on the end of the extension arm, to use the words of the inventor, is to "mass and make the skin surrounding the spot where the dimple is to be produced, malleable."

Leaving this bit of information concerning medical patent models, a review is given of some of the early United States inventions designed to simplify the work of pharmacists. Those which reached the Museum are listed below in chronological order, with a brief description of each taken from the patent specifications.

Patent No. 341.—A device for spreading plaster upon cloth, invented by B. Morison, Milton, Pa., and patented August 8, 1837. The apparatus is a frame 18" high and 18" square, having four legs which give it the height of an ordinary table. In this frame are two parallel rollers, with turning cranks on opposite ends, a small wooden one and a larger one of metal, the latter being directly under a triangular vat, called the spreader, for holding the plaster mass. The plaster, melted to the consistency of molasses, is now poured into the spreader, and spread on the cloth to the required thickness.

Patent No. 3619.—A machine for making mercurial ointment, invented by James W. W. Gordon, Baltimore, Maryland, and patented June 5, 1844. The materials to be mixed are placed in a vertical cylinder which is securely fastened to the bottom of the machine. Knives, or cutters, are attached to blades at the end of a piston rod which is operated by a crankshaft at the top of the framework. The up and down motion of the knives fastened to the rotating blades of the piston extinguish the mercury in the materials into which it is to be incorporated.

Patent No. 7323.—An apparatus for spreading and gaging plaster for pharmaceutical purposes, invented by James M. Keep, Bath, Maine, and patented April 30, 1850. This apparatus consists of an adjustable table with clamp frame adapted thereto, both of which can be expanded or contracted to graduate them to the size of the plaster required, and so constructed and arranged that the material employed for the purpose is held firmly during the operation of overlaying it with the adhesive substance by means of a heated iron; the material being evenly spread and leaving a border or selvage around the edge of the plaster.

Patent No. 8556.—A paper-crimping press, invented by Carlos A. Cook, Lowell, Massachusetts, and patented December 2, 1851. By a particular arrangement of upper and lower crimping surfaces, paper is crimped in a trough-like shape, which renders it very convenient to be filled with a powder. The upper part of the apparatus being opened on its hinges, the paper of required size is laid on the surface of the lower section. The operator then pulls the upper section forward and closes it sharply upon the paper. When the upper part is raised, the paper will be found to be properly crimped and ready to receive its powder and be folded.

Patent No. 14161.—A pill machine invented by Noah W. Kumler, Cincinnati, Ohio, and patented June 22, 1856. This invention consists of plates of wood or metal placed the required distance apart, and all or part of them adjustable by means of set-screws, or otherwise. A pulley and belt draws the pill material between the plates and rolls it out to any required size in the shape of cylindrical rods. These rods are conducted to a revolving metal roller provided with semicircular grooves cut around its circumference. The rods of pill material are carried between the face of this roller and a segmented plate of metal furnished with semicircular grooves similar to those on the face of the roller. The projections formed by the grooves on the roller and segmented plate cut the rods of pill material into the required sizes. These pieces are rolled around by the motion given to the roller until formed into pills suitable for use. The pills are finally discharged from the machine ready for use.

Patent No. 17865.—A globule machine invented by James C. Ayer, Lowell, Massachusetts, and patented June 28, 1857. This apparatus first forms the semisolid material of which the globules are to be made into cylindrical rods. This is accomplished by compressing the mass through a strong cylinder with great force. Globules are formed from these rods when the rods are passed broadside through two corrugated cylinders, one of which is revolving at greater speed than the other.

Patent No. 31998.—An apparatus for distilling oils and other substances, invented by Abraham Quinn, New York City, and patented April 9, 1861. The invention consists, principally, of an inverted siphon applied and arranged in combination with a still and condenser. The purpose of the invention is, *first*, to make possible the distilling and refining of oils with one operation and by the same heat without the use of agitators, pumps or similar machinery; *second*, to serve as a safety-valve when paraffin or palm oil has been allowed to solidify in the condenser; *third*, to act as a vacuum-chamber to prevent oil boiling over from the still into the condenser and mixing with the distilled oil in the receiver; and *fourth*, to serve as a means of running back a portion of the oil to the still.

Patent No. 32642.—A machine to fill and fold medical powder papers, invented by Mark S. Palmer, New Bedford, Mass., and patented June 25, 1861. This invention consists of certain novel improvements for preparing strips of paper, filling them with certain quantities of powder and folding the powder in the papers in a proper manner and shape for medical purposes. The invention is intended more especially for folding papers containing homeopathic powders, and for folding and filling papers with Seidlitz powders, but by varying the size of the parts which receive the papers and fold them, the machine may be adapted for folding large or small papers of powders.

Patent No. 49242.—A mold for the manufacture of capsules invented by Dundas Dick, New York City, and patented August 8, 1865. In this mold there is a fixed center core, which center core is surrounded by two similar side pieces hinged to a common bed-plate. When the side pieces are closed and the ordinary gelatinous composition of which capsules are formed is poured into the top opening of the two side pieces the space around the core is filled. When the mass has cooled sufficiently and hardened to retain its shape, the sides of the apparatus are dropped and the capsule is removed from the core. The capsule is then filled with the desired material and closed at its mouth by dipping in hot gelatin or other suitable material.

Patent No. 57071.—A portable drug crusher invented by H. C. Becker, New York City, and patented August 14, 1866. This apparatus consists of a semi-oval plate, either of wood or iron, with a rim of wood, iron or copper running around about two-thirds of the plate, to prevent the drugs from falling off. A small round hole is made in the plate through which the cut and crushed material can pass into a receiver. Attached to the plate close to the square end and slightly raised above the flat surface of the plate, is a cutter and crusher of steel, in one piece, and secured to the plate by two screws, which makes it possible to change the cutter and crusher when necessary. At the end of the cutter is a handle by means of which the machine is put in operation.

Patent No. 63208.—An apparatus for mixing powders invented by Jabez Burns, New York City, and patented March 26, 1867. It consists of a movable agitator in the interior of a drum, to which a revolving motion can be imparted, and which is provided with a feed opening in such a manner that the agitator can be readily removed and cleaned. The agitator consists of a series of spiral flanges, which are secured to one of the heads of the drum, and this head made removable, so that by the action of the spiral flanges the materials to be mixed are thrown toward the movable head where they can be removed.

Patent No. 63814.—An apparatus for making medical plasters invented by Albert D. Richards, Lowell, Mass., and patented April 16, 1867. Upon a block of wood is affixed a bed-piece. The upper surface of this bed-piece is concave. This concavity is bounded on all sides by a sharp edge. Hinged to one end of the wooden block is a shield or pan. Having a quantity of the plaster mass in the pan, a sufficient amount of it is drawn to the bed-piece. A spreader in the form of a warm roller then draws the plaster evenly over the bed-piece.

Patent No. 96038.—An apparatus for dividing powders invented by Frederick Schaeffer, Philadelphia, Pa., and patented October 19, 1869. This invention rapidly and accurately divides masses of powder into a number of equal portions. It is useful for many purposes, but is especially intended for dividing medicinal powders into small quantities suitable for packing in papers. The apparatus makes it possible for the medicine to be packed without handling, and without any

of the usual weighing and measuring. The dividing is done by means of wedge-shaped blocks.

Patent No. 104181.—A percolator invented by Albert Merrell, Cincinnati, Ohio, and patented June 14, 1870. This apparatus consists of two conical-shaped vessels one resting above the other in a suitable frame. In using the apparatus, the substance to be percolated is placed in the upper vessel on a perforated septum. The covers are tightly bolted on, and the upper, middle and lower openings closed. The air is then exhausted from the entire apparatus. By opening a valve at the top of the upper vessel, the percolating liquid is allowed to flow into the vessel. After maceration has progressed for a proper length of time, the valve between the two vessels is opened and the percolate passes into the lower vessel, the receiver. The operation can be hastened by pumping air into the upper vessel through a valve provided for that purpose until any desired pressure is produced.

Patent No. 113453.—An apparatus for spreading medicinal plasters invented by Adolph J. Schafhirt, Washington, D. C., and patented April 4, 1871. The object of this invention was to provide an adjustable apparatus, by means of two perforated plates sliding one upon the other, whereby different sized plasters might be made, "such want being long felt by the druggist and apothecary."

Patent No. 132200.—A device for cutting and shaping pills invented by John Cooper, Philadelphia, Pennsylvania, and patented October 15, 1872. This invention is a machine with moving plates in pairs, the grooves of which will match to make the required size of pill. One machine supplied with these moving plates will take the place of several machines heretofore required for the several sizes. The first part of the invention consists in combining with the bed and sliding beam of a pill-cutting machine, a series of movable plates so fitted that one pair may be removed and another pair substituted in order that a pill of a different size may be made on the same machine. The second part of the invention consists in grooving both sides of these movable plates so that fewer plates are required in the set. The other part of the invention relates to the ready adjustment and securing of the plates in their positions.

Patent No. 132614.—An apparatus for spreading plasters invented by Nathan Wood, Portland, Maine, and patented October 29, 1872. This invention consists of a metal fire-box containing a lamp; a table on top of the fire-box; and a platen for spreading the plaster in the center of the table.

Patent No. 139858.—A suppository mold invented by Lyman R. Blackman, Newport, Rhode Island, and patented June 17, 1873. This invention consists of two plates of about equal thickness, the upper one perforated and the lower one containing depressions equal in number to the perforations in the upper plate. The two plates are separable, and adjustable by means of set pins and grooves, so that the openings in the upper plate register with the depressions in the lower plate, forming when taken together, a conical mold. In using the device the two plates are placed together. The melted suppository mass is poured into the molds and allowed to cool. When the suppositories have hardened, the mold is turned upon its face and the lower plate lifted off. This releases the tips of the suppositories. A gentle tap on the other plate disengages the body of the suppository.

Patent No. 142524.—A suppository mold invented by Peter I. Spenzer, Cleveland, Ohio, and patented September 2, 1873. This device consists of two bars of metal, hinged together at one end, with handles at the opposite ends, and having within their contiguous faces a series of grooves, which, when the jaws are closed together, coincide, so as to form cavities that, horizontally, are circular, and vertically decrease regularly in dimensions from their upper ends downward. In use the jaws of the device are closed. Melted suppository mass is poured into the molds. When cool the jaws are opened and the completed suppositories drop out.

Patent No. 146549.—A suppository mold invented by James H. Plaisted, Waterville, Maine, and patented January 20, 1874. This mold consists of two parts which are separated to remove the suppositories. These two parts are so constructed that they may be separated by a sliding motion in the direction of the axis of the suppository, while a lateral sliding motion or a direct separation is prevented. The object is to facilitate the removal of the suppository from the mold, and to diminish the danger of breaking it.

Patent No. 147831.—A lozenge cutter invented by James A. Dingwall, New York City, and patented February 24, 1874. The purpose of this device was to provide a method of cutting lozenges with greater rapidity either by hand or machine power. The apparatus consists of a

supporting frame, to which the perforated main plate, with tubular cutters, is attached, which guides in suitable holes and recesses of the frame, the perforated spring plate, which passes up around the tubes on pressing the cutter into the lozenge mass, and detaches, by its downward motion, the waste parts from the cutter tubes, while the cut lozenges are carried upward.

Patent No. 150307.—A percolator invented by Laurent Dursse, Grafton, West Virginia, and patented April 28, 1874. This invention relates to glass percolators used in the preparation of medicines. In use, the powdered drug is placed in the conical glass receptacle with the menstruum or solvent, and the bottom of the percolator is closed as soon as the liquid has permeated the mass and begins to drop. The percolator is then covered and put in a moderately warm place for a few days. The main feature of the invention is the air-tight cover to prevent evaporation.

Patent No. 154708.—An apparatus for spreading plasters invented by William G. Neubauer, Long Island City, New York, and patented September 1, 1874. This apparatus is composed of an upper part or bed, and a lower part. These two parts are hinged together, and form a receptacle for the pattern plates and spreader used in the process of spreading plasters.

Patent No. 159899.—A portable machine for sugar-coating pills, confectionery and other substances, invented by William Cairns, Jersey City, New Jersey, and patented February 16, 1875. This invention consists of a furnace or heater and swivelling pan. Gear for rotating and moving the pan is attached to it. The pan may be of the same shape as the ordinary steam pan, and be set to revolve at an angle to the horizon, as usual in sugar-coating machines driven by hand or steam power. The machine, which is devised to operate by hand, instead of having a pan surrounded by a steam coil, is arranged to be heated by a stationary heater or furnace beneath the pan. The pan can be swivelled across the fire or away from it, thus regulating the heat as desired.

Patent No. 162673.—A regulating percolator invented by George McPherson, Chicago, Illinois, and patented April 27, 1875. This invention consists of a faucet connected to a closed cap upon the head of the percolator, the faucet being provided with depressions upon its outer periphery, whereby the operator is enabled to control the admission of air, to regulate the progress of the menstruum through the drug in the percolator and to secure, in a convenient manner, time for the more thorough extraction by maceration of the medicinal principles contained in the drug, while, during the process, loss of alcohol or ether, and other volatile and expensive liquids by evaporation is entirely prevented. The invention further consists of a pump or air-forcing apparatus, whereby the air may be compressed above the menstruum and the percolation accelerated according to the degree of pressure.

Patent No. 163552.—A pill tile invented by William E. VanVelsor, Philadelphia, Pennsylvania, and patented May 18, 1875. This invention consists of a glass pill tile having a ground surface to prevent the slipping of the pill mass, and a scale to be used in cutting pills to their proper size.

Patent No. 171699.—A lozenge machine invented by Thomas Robertson, Toronto, Ontario, Canada, and patented January 4, 1876. This invention has four principal parts, as follows: 1st, a printing block or head, with adjustable dies affixed, attached to sliding standard and worked by a suitable arrangement of levers, for printing the paste as it lies on the cutting board; 2nd, adjustable hollow dies or cutters, affixed to a cutting head, to which a reciprocating up and down motion is given by a pair of revolving wheels, each having an eccentric channel sunk in its face, in combination with side standards, to which the cutting head is attached, to cut the sheet of paste as it lies on the cutting board into lozenges of any desired shape or size; 3rd, a series of pushers to remove the lozenges, when cut, from the hollow dies, and place them regularly on suitable drying frames; and 4th, apparatus to feed the cutting boards and drying frames forward automatically.

Patent No. 178183.—A pill-coating machine invented by Henry C. Neer, Park Ridge, New Jersey, and patented May 30, 1876. This invention consists of a bed-plate containing receptacles for pills, a covering plate, a guide plate and a needle plate provided with needles. In operation a pill is suspended on each needle and then dipped in the coating substance.

Patent No. 187279.—A machine for cutting gelatin capsules off the molds on which they are formed, invented by Frederick A. Hubel, Detroit, Michigan, and patented February 13, 1877. This apparatus consists of a series of small circular knives which revolve horizontally, and work in

connection with springs, screws, cogwheels, cranks, platforms, slides, levers and cylinders. The circular knives rotate around the mold and cut the capsule at the required length.

Patent No. 190564.—A machine for putting up Seidlitz powders invented by Charles R. Doane, Brooklyn, New York, and patented May 8, 1877. In this machine the combination of two distinct and separate mechanisms operate alternately from a central shaft having a reciprocal rotary motion, whereby the alkaline and acid powders are put up in papers and alternately deposited outside of the machine.

Patent No. 197779.—A pill machine invented by John Hill, South Norwalk, Connecticut, and patented December 4, 1877. This invention consists of a series of blades fixed to a vibrating bar, and adapted for dividing the rolls of pill mass upon a table in combination with pivoted clearers which separate the mass from the cutters. Having prepared a roll of pill mass of the desired length, it is adjusted on the table beneath the clearing teeth and divided by depressing the knives. The knives and clearing teeth are then raised and thrown back out of the way, and the bits of pill mass are removed from the table and rolled into pills.

Patent No. 202268.—A measuring bottle stopper invented by Wilmer L. Keller, Baltimore, Maryland, and patented April 9, 1878. This device consists of an ordinary stopper with a measuring graduate placed on its lower end. The measure corresponds very closely to the ordinary fluid measures in common use, it differing from them only in that the flare of the sides is somewhat reduced in order to allow the measure to be inserted in the neck of the bottle to which the stopper is applied. By means of this invention the loss usually experienced in cleansing measures of the liquid adhering to them is prevented, the liquid passing again to the bottle after the insertion of the stopper therein. The time spent in cleansing measures is saved.

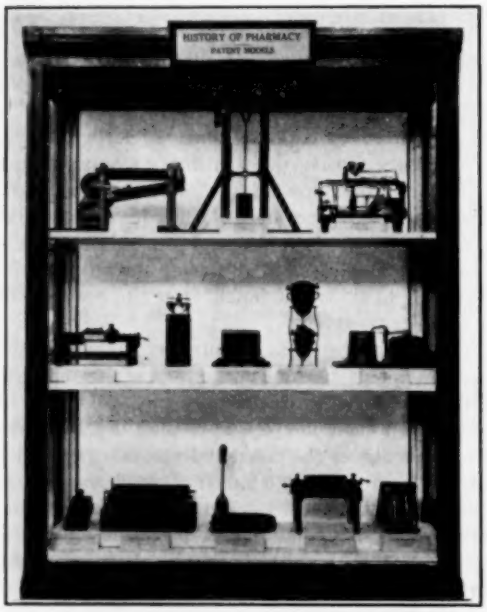
Patent No. 210589.—A machine for filling and capping capsules invented by Thomas Whitfield, Chicago, Illinois, and patented December 3, 1878. This machine is operated in this manner: a plunger is raised by a spring to its highest position and a rod is drawn downward. The cap of a capsule is passed in an inverted position through an aperture in the side of the tube, and then forced up against a funnel by a spring. A sufficient portion of the powdered substance to be inclosed in the capsule is next fed, by means of a spatula, from the trough into the funnel, the powder falling loosely over the inverted capsule cap in the base of the funnel. The shell of the capsule, mouth downward, is dropped into the funnel, and by pressing on the finger piece the plunger is caused to swing around into position over the tube by the pin, traveling in the spiral portion of the groove, and then to descend into the tube, forcing the shell of the capsule down on the material in the base of the funnel, thus filling compactly both parts of the capsule, and uniting them securely at the same time and by the same movement. By drawing down the rod the capsule descends and falls out at the aperture in the side of the tube.

Patent No. 211733.—Certain improvements for his pill machine (Patent No. 197779) were invented by John Hill, South Norwalk, Connecticut, and patented January 28, 1879. The improvements consist, mainly, in combining with the vibrating knives and clearing teeth or comb, a graduated scale-bar and an adjustable indicating finger, for the purpose of quickly determining the proper length to roll the pill mass for cutting a given number of pills; also, in combining with the vibrating knives and comb, a self-adjusting locating plate, which will gage the proper position for locating the rolls of pill mass under the knives; also in the employment of stop arms at the ends of the machine, which will serve as stops or rests for the comb when down, one of which arms will also serve, in connection with the adjustable indicating finger, as a means of determining the proper lengths for the rolls of pill mass.

Patent No. 214775.—A suppository mold invented by Henry R. Heyl, Philadelphia, Pa., and patented April 29, 1879. The mold is operated as follows: a plunger is elevated and a hopper supplied with suppository material. This material is forced into the mold by the plunger. The flask is then removed from the frame shearing off the suppository even with the top of the mold thus insuring uniformity in size and contents of the suppositories.

Patent No. 216197.—An apparatus for capsulating medicaments invented by Stanislas Limousin, Paris, France, and patented June 3, 1879. This invention consists of a perforated plate to receive wafers while being filled, funnels for pouring medicaments into the wafers, a receptacle for holding moisture or adhesive material, and reversible stamps provided at each end with concave faces, one face serving to moisten the edges of a wafer, and the other serving to press the edges of two wafers together.

Patent No. 216899.—A bottle-washing machine invented by Rudolph Schultz and Emil O. Nagel, Detroit, Michigan, and patented June 24, 1879. In the operation of the machine one of the faces of the shaft is presented upward, the bottles to be cleaned set into the recesses of the cog wheels, and the small yokes raised sufficiently to allow the neck of the bottle to enter the inner ends of the tubes, the stop-cocks of which are open. The shot receptacles are then removed, filled with shot and replaced, when the shot will pass through the tubes into the bottles. The stop-cocks are now closed, the next face of the shaft presented, and the same operations performed until the various faces of the shaft are filled with bottles to be cleaned. The shaft is then rapidly rotated, whereby the shot are thrown from top to bottom of the bottles, and in all directions, cleansing thoroughly the interior of the bottles, while the brushes are cleaning the exterior of the bottles. When this is sufficiently done the stop-cocks are opened in each series, when the mouths of the bottles are presented vertically downward to retain the shot in their receptacles, into which they will pass when the bottles are in the position last described.



Case 1.—Pharmaceutical Patent Models.—*Courtesy of U. S. National Museum.*

From left to right on each shelf. Shelf 1: 1. Plaster machine (14161); 2. Ointment machine (3619); 3. Machine to fill and fold powder papers (32642). Shelf 2: 1. Machine for making globules (17865); 2. Apparatus for mixing powders (63208); 3. A powder paper crimping machine (8556); 4. Percolator (104181); 5. Apparatus for distilling oils (31988). Shelf 3: 1. Apparatus for making medical plasters (63814); 2. Apparatus for dividing powders (96038); 3. Portable drug crusher (57071); 4. Device for spreading plaster on cloth (341); 5. Apparatus for spreading and gaging plaster (7323).

Patent No. 223139.—An improvement for his machine for cutting gelatin capsules off molds (Patent No. 187279) invented by Frederick A. Hubel, Detroit, Michigan, and patented December 30, 1879. In practice the molds are immersed to the proper depth in gelatin. After the molds have received a coating of sufficient thickness the slides are placed upon a platform and secured in place by a crank and block. The platform is then raised to the proper height. A lever drawn forward puts the cutting knives in contact with the molds. The crank is rotated and causes the knives to cut the gelatin.

Patent No. 223140.—A device for removing capsules from molds invented by Frederick A. Hubel, Detroit, Michigan, and patented December 30, 1879. This device pulls capsules from the molds on which they were formed. The invention consists of spring clutch bars, vertically adjustable in a suitable frame, which embrace the molds below the base of the capsules, and draw the capsules from the molds.

Patent No. 224734.—A suppository mold invented by James W. See, Hamilton, Ohio, and patented February 17, 1880. This invention consists of one cylinder sliding within another. The mode of operation is as follows: the parts are placed together and held fast by a set screw. The cavities in the cylinders form the molds. These molds are filled and cooled as usual. Then the inward cylinder is pushed slightly downward through the outer one. This loosens the suppositories from the inner ring. The inner cylinder is then pushed upward and out of the outer ring. The suppositories drop from the inner ring.

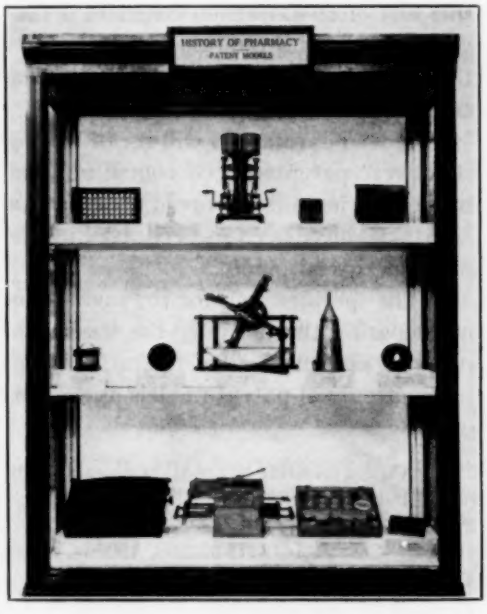
Patent No. 311835.—A machine for joining the two parts of a gelatin capsule invented by Frederick A. Hubel and Frank J. Reinhold, Detroit, Michigan, and patented February 3, 1885. The mechanism consists of a tube having a portion of its bore enlarged to receive the cap of a

capsule. At the point of enlargement is a shoulder against which the open end of the cap may rest, a plunger to hold the cap therein for a period and then permit it to be removed and a plunger to push the body of the capsule through the tube into the cap, and then expel the joined capsule.

Patent No. 316896.—A device for stirring melted gelatin invented by Frederick A. Hubel and Frank Reinhold, Detroit, Michigan, and patented April 28, 1885. Gelatin capsules were made by dipping metal pins held in a plate into a bath of melted gelatin. The pins being colder than the gelatin, chill a thin film of gelatin which adheres to the pins, and, after being cut to length

Case. 2.—Pharmaceutical Patent Models.—*Courtesy of U. S. National Museum.*

From left to right on each shelf. Shelf 1: 1. Suppository mold (214775); 2. Machine for sugar-coating pills (159899); 3. Percolator (162673); 4. Capsule machine (210589); 5. Machine for cutting capsules off molds (223139). Shelf 2: 1. Suppository mold (142524); 2. Pill machine (197779); 3. Lozenge machine (171699); 4. Pill machine (211733); 5. Device for stirring melted gelatin (316896). Shelf 3: 1. Apparatus for spreading plasters (113453); 2. Machine for cutting capsules off molds (223140); 3. Device for cutting and shaping pills (132200); 4. Machine for cutting capsules off molds (187279); 5. Pill tile (163552).



Case 3.—Pharmaceutical Patent Models.—*Courtesy of U. S. National Museum.*

From left to right on each shelf. Shelf 1: 1. Lozenge cutter (147831); 2. Measuring bottle stopper (202268); 3. Seidlitz powder machine (190564); 4. Mold for manufacture of capsules (49242); 5. Apparatus for spreading plasters (132614). Shelf 2: 1. Pill coating machine (178183); 2. Suppository mold (139858); 3. Bottle washing machine (216899); 4. Percolator (150307); 5. Suppository mold (224734). Shelf 3: 1. Apparatus for spreading plasters (154708); 2. Capsule machine (311835); 3. Apparatus for capsulating medicaments (216197); 4. Suppository mold (146549).

and removed from the pins, form one part of the capsule. In order that the finished capsules may be of the same thickness, it is necessary to keep the gelatin at the same temperature, and this can only be done by stirring the gelatin, as the surface, which is exposed to the air, becomes colder than the lower portion which is nearer the source of heat. In stirring by hand or from the surface in any way bubbles of air are apt to be caught in the gelatin and make bad spots in the capsules.

This list of pharmaceutical inventions is convincing evidence that the machinery utilized in modern medicine making has come into existence as the result of experimentation and research by many workers in various parts of the country.

It is not known what proportion of the patents granted in the United States have to do with the manufacture of medicines, but it is believed that pharmacy is as well represented as other comparable branches of industry. The development of apparatus and machines for the simplification of pharmaceutical tasks has been sufficient to evoke the complaint, occasionally heard from the laity these days, that medicine making has become more or less of a mechanical process. The answer to this sort of unwarranted criticism is that we have been living in a machine age for some time, and if pharmacy had not adapted itself to the mass production ways of the times it could not have kept its head above water, and would soon have been accused of being unprogressive.

Older pharmacists will recall having used some of the listed inventions just as they were patented. Of course most of the apparatus described is obsolete now, but the principles involved in many of the inventions, with improvements and additions, have been incorporated in the apparatus and machinery used in modern pharmaceutical plants.

The specifications for the inventions listed are in most cases quite lengthy, and in preparing the list only the least information necessary to describe the general purpose and method of operation of each invention has been abstracted. The pharmaceutical patent models appear in the cases shown in the illustrations in this order:

Case 1 (reading left to right on each shelf, top to bottom) 14161, 3619, 32642, 17865, 63208, 8556, 104181, 31988, 63814, 96038, 57071, 341 and 7323; Case 2, 214775, 159899, 162673, 210589, 223139, 142524, 197779, 171699, 211733, 316896, 113453, 223140, 132200, 187279 and 163552; Case 3, 147831, 202268, 190564, 49242, 132614, 178183, 139858, 216899, 150307, 224734, 154708, 311835, 216197 and 146549.

If further particulars are desired they may be obtained from the patent specifications, copies of which can be procured from the Commissioner of Patents, United States Department of Commerce, Washington, D. C., for ten cents each. In applying for a patent specification, the patent number, the name of the inventor and the name of the object patented should be furnished.

Pharmacists have every reason to be proud of the way the profession adapts itself to the constantly changing conditions which it encounters in the never-ceasing battle against the forces of disease. The genius of pharmaceutical inventors has played a large part in making this possible. All praise to them.

PHARMACY WEEK.

The information received so far indicates that Pharmacy Week has been more generally observed this year than ever before. The national, state and local pharmaceutical associations and the pharmaceutical press have given this observance wide publicity and judging from the increased demand for the Pharmacy Week stories, and other information, many have appeared in local publications and many addresses have been given before civic and other organizations, or over the radio.

To make this movement fulfil the ideals of its founder requires the coöperation of every one interested in professional pharmacy; and to some extent, at least, every week should be a "Pharmacy Week," during which some effort will be made to acquaint the public with the professional services of Pharmacy.

THE CHAIN AND INDEPENDENT DRUG STORE SITUATION AS REVEALED BY THE CENSUS OF AMERICAN BUSINESS.*

BY FRANK A. DELGADO.[1]

In the Capitol at Washington, in state legislatures, in schools and colleges, in the daily press, in magazines and trade journals, the subject of competition between chains and independents is a topic of frequent and earnest debate, study and discussion on the part of legislators, manufacturers, wholesalers and retail distributors, and perhaps most important of all, consumers.

The independent merchant may no longer sit back and calmly be consoled with platitudinous and "pollyanna" remarks to the effect that consumers do not want to buy at a chain store and all the independent has to do is to follow a set of golden rules such as employing personality, giving service, displaying merchandise, keeping his store clean, etc. If it were that simple, a former President of the United States, presaging a threat to the security of the independent merchant, would not have remarked less than ten years ago: "The foundation of American business is the independent business man. We must maintain his opportunity and his individual service." It was at this time that a former Cabinet officer, alarmed by the situation that seemed to confront the independent, remarked:

"The present position and future prospects of the retailer, particularly the small independent operator, unquestionably constitute one of the most vital questions now before this country. It is fraught with momentous issues, with great possibilities of broad social improvement, and on the other hand with stark alternatives of possible misfortune for many thousands of our citizens."

These things that were being said ten years ago are still being said; for the need for them still exists, as evidenced by figures recently released by the U. S. Bureau of the Census based upon the Census of Business for 1935, which show that chain stores of all types enjoyed 22.8 per cent of total retail sales during 1935 as against 20 per cent in 1929, a gain of 2.8 per cent. On the other hand, independents accounted for only 73.1 per cent of total retail sales in 1935 as against 77.5 per cent in 1929. No doubt facts such as these moved Col. Charles H. March, member of the Federal Trade Commission, to remark about two months ago before an assemblage of retail grocers gathered in Boston:

"We were nourished by the philosophy that ability, courage and honesty reaped the glittering prize of business independence. To-day most of us in industry work not for the Government, but for entities quite as impersonal and frequently as remote. The giant monopoly has snared most of us on its pay roll and the old order of the independent proprietor is fast fading away."

Col. March is not sure that independent merchants in this country, in view of monopolistic trends, "will long continue to maintain their independence."

To cloud the horizon a new type of competition has recently entered the field, and that is chain store organization that has adopted a new policy of leasing drug and cosmetic departments in department stores.

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* Parts of an Address delivered before the Section on Commercial Interests, of the AMERICAN PHARMACEUTICAL ASSOCIATION Annual Convention held at New York City, August 20, 1937.

[1] Business Specialist, Bureau of Foreign and Domestic Commerce, U. S. Department of Commerce, Washington, D. C.

The second type of competition that seems to be causing even greater alarm in the trade is the so-called super markets. According to trade journal reports:

"Six months ago there were approximately 2000 super markets in the United States; to-day there are more than 3000 with 75 per cent of the new establishments equipped with drug departments.

Then there is a third type of competition, although it does not differ widely from existing types, and in fact already exists in many cities and towns, and that is the local chain.

I do not agree with some authorities who feel that the growth both in number and sales volume of chains has been arrested and that the early advantages of the chain are disappearing.

In this connection, Hugh M. Foster, in *Printers' Ink* for April 1937, said:

"The chain-store business reached its peak about 1929. Then it ran along at an approximate level to 1931 and dropped rather sharply in 1932, with a further drop in 1933. The rise with the general recovery began in 1935 and continued on an increased upward slant throughout 1936. There is, therefore, a reasonable prospect of a new peak in the next year or two which may well exceed not only that of 1929 but also that of 1936."

The biggest mistake that independents can make is to be too independent and under-estimate the chain. This is particularly true of drug chains which have had and are having a house-cleaning. For example, a few years ago it was generally admitted that drug chains did not cater to prescription business. That statement does not hold true to-day and can best be illustrated by the prescription record of a chain with approximately 120 stores in the Middle Atlantic area that in 1932 filled a total of only 270,000 prescriptions but in 1935, as a result of systematic prescription department promotion, increased this business to 540,000 prescriptions. Last year they added another 100,000 prescriptions, making the total 643,000. Based on figures compiled for the first 7 months of the current year, this chain will probably fill 750,000 prescriptions in 1937. Furthermore, over 50 per cent of the managers of this particular chain are registered pharmacists. This chain recognizes the importance of employing only the highest grade registered pharmacists. They pay registered pharmacists beginning salaries of $45.00 a week.

I believe you will agree with me that this is a real achievement—a record that any druggist, chain or independent, would be proud to equal.

Statistics, though generally regarded as dry, are nevertheless essential for the rational conduct of any business, whether it be national in scope or confined to the cross-roads.

Let us then examine some of the Census of Business statistics for 1935 and see what they tell us about drug stores.

The Bureau of the Census figures show that chain retail stores of all types decreased from 148,000 units in 1929 to 127,000 units in 1935, while independent units increased from 1,376,000 units in 1929 to 1,474,000 units in 1935. We must examine all the facts, however, to obtain the complete picture. This situation is probably the result of the closing of unprofitable chain store units due to chain store taxes and other causes and the concentration of business in larger units.

There were 3744 drug chain units in the United States in 1935; 3107 with and 637 without fountains, or, roughly, 5 with fountains to one without. In 1935, chain drug stores did a total of $316,807,000. Over $273,000,000 of this amount was for chains with fountains. While the total number of retail drug stores in 1935 was considerably less than in 1929, this loss was suffered by

independent drug stores, for we find that the number of drug chain units increased from 3513 units in 1929 to 3744 in 1935. The study also shows that the tendency is for drug chains to add fountains.

Independent drug stores continue to do a smaller share of the total retail drug business. In 1929 they accounted for 81.2 per cent of the total; in 1935, 74 per cent and in 1935, 71.1 per cent. Conversely, chain drug stores accounted for 18.5 per cent in 1929; 25.1 per cent in 1933 and 28.8 per cent in 1935. In 1935, facts were collected for drug stores with and without fountains. The figures cited are for drug stores with fountains, which account for the bulk of such stores. Over 38 per cent of the independent drug stores in 1935 did an annual business of less than $10,000, and over 16 per cent did a business of less than $5000. In fact, less than 4 per cent of all the independent drug stores did an annual business of over $50,000. In contrast with the independent drug stores, we find that over 64 per cent of chain drug stores did a business of over $50,000. Incidentally, drug stores without soda fountains show 54 per cent of all drug stores doing less than $10,000 a year. Drug stores with fountains received $121,000,000 from the sale of meals and from fountains during 1935, accounting for 6.8 per cent of the total sales of meals for the whole country. The drug store as a whole apparently has little to worry about as far as credit sales are concerned, for the Census figures show that during 1935, 92.1 per cent of the retail drug business was done on a cash or c. o. d. basis as against approximately 68 per cent for all retail stores.

Among the numerous facts ascertained by the Census Bureau during the conduct of the Census of Business for 1935 was that 19.8 per cent of all drug store employees are women as against 30.5 per cent for all kinds of retail stores. This ratio is about 2 per cent higher in drug stores without fountains. The Census Bureau also tells us that in 1935 there were 608 negro drug stores, or slightly over one per cent of the total. Of these 608 negro drug stores, 298 had soda fountains.

The average operating expense for all drug stores shows a tendency to increase. The figure for 1929 was 22.8 per cent, and for 1935, 23.7 per cent. The percentage would be considerably higher if services of proprietors were included. For example, in 1929 instead of 22.8 per cent, expenses would have been 27.11 per cent. For comparison with the Bureau of the Census chain store expense figures, we have those taken from the Federal Trade Commission reports which cover the period 1913–1930 and show all types of chain stores had an operating expense of 24.25 per cent in 1913 followed by a lower ratio for 16 years and then an increase upward to 24.15 per cent in 1930.

There is no lack of statistical evidence relative to the operating expense of chains and independents in drug and other fields. In fact, the Census of Distribution for 1929 showed that chain store expense was approximately one-half of one per cent greater than average drug store expense. If, then, the chain does not operate more economically, does it buy at lower prices than its independent competitor? According to the Federal Trade Commission figures, it does. Their final report states that much larger proportions of chain than of wholesale accounts are found in the higher allowance brackets (15 per cent and up).

The question arises, were these larger discounts granted by manufacturers because the chains were, on the average, much larger than the wholesalers, or were they granted because of the superior bargaining power of the chains? Manufacturers grant lower discounts for both these reasons. Some chains have the capacity to buy in unusually large quantities, considering the particular trade. And it is equally true, according to the Federal Trade Commission, that chains have forced down the offered price below the cost of manufacturing the merchandise and handling the order as specified by the chain buyer.

Many chains contract for a large quantity of merchandise, receiving a good quantity discount on the basis of their needs for an entire year, and then require small frequent shipments and billings to individual stores. Although the cost of making one large sale is less, the actual cost of preparing the shipments, sending them out of the warehouse, billing and collecting may be just as much as, if not more than, the cost of handling the accounts of smaller independent competitors, especially wholesalers who buy in car lots.

Other statistics of an unofficial but what is believed to be a reliable source tell us that every year changes in the retail drug field exceed 17 per cent. In 1936, 10,974 drug stores underwent significant changes—changes filled with importance to every branch of the drug trade. For with them come profits—or losses. For example, 4750 new drug stores were opened in 1936 but 2285 went out of business and 880 others changed their location. New management took place in 3059 drug stores. The retail drug trade shows a surprisingly uniform rate of new drug stores—succession, removals, retirements and like changes.

Recognizing the importance of the consumer's good-will, the chains through the "Institute of Distribution," 570—7th Avenue, New York City, have prepared such booklets as (1) "33 Questions and 33 Answers Important to Your Pocketbook," (2) "Taxes That Soak Mr. & Mrs. Consumer," and (3) "Chain Store Manual." In these books they tell the consumer what chain stores mean to the United States. They tell them, for example, that chain stores purchase 5 billion dollars worth of merchandise annually from domestic manufacturers, that they spend $454,000,000 in rent and $200,000,000 for advertising and $419,000,000 for freight and $983,000,000 to their employees and $173,000,000 for state and local taxes and that they save their patrons annually $776,000,000.

If you will agree that the figures regarding chain store sales, purchases and expenditures for rent, advertising, employees' salaries, etc., enumerated are very impressive especially when brought to the attention of the reading public, yet they do not seem so significant when you are made aware that in 1935 there were 1,474,000 independent retail merchants employing 2,839,000 employees or three times as many as the chains, with a pay-roll not including proprietors' salaries of $2,559,000,000, or more than two and a half times that of the chains. In addition, independent retail merchants had other operative expenses amounting to $829,000,000. This sum was spent for rent and such other expenses as insurance, light, heat, telephones, taxes, water, interest, legal fees and was circulated in various channels which vitally affect the incomes of the consumers of this country. The Bureau of the Census statistics also tells us that approximately 57,000 independent druggists, and an additional 1,417,000 independent merchants who, it is alleged, make most of their purchases from 177,000 wholesalers, doing an annual business of approximately $43,000,000,000 and employing 1,278,000 employees, nearly 19 per cent of whom are women, pay these employees $2,049,000,000 in salaries.

An editorial in the August 1937 issue of a leading drug-trade journal points out that the public fails to realize the comparatively high operating expenses of a retail drug store unless such matters are clearly and forcefully brought to their attention. It is stated:

"They are matters which must be explained to counteract the propaganda of price-cutters who are doing their best to arouse consumer objections to fair trade laws by raising the cry of high prices."

The editorial concludes with a statement to the effect that

"Retailers individually and collectively must undertake the education of the consumer in fair trade and that the movement must not go down under consumer pressure which is aroused because the consumer does not understand all the pertinent facts."

Evidence that independents are recognizing the necessity of educating the consumer is at hand. Pharmacists in New York State have formed what is known as the Fair Trade Committee of the New York State Pharmaceutical Association. The Committee plans a survey to determine how retail prices on drugs and cosmetics have been effected by the Feld-Crawford Act, New York State's Fair Trade Law. Chairman John F. O'Brien, of the Fair Trade Committee of the Association, is chairman of the Survey Committee. Serving with him are a number of prominent executives of drug wholesale, pharmaceutical and toiletry manufacturing fields. The price study is prompted, it was pointed out, because of charges made that the

Fair Trade Law had increased prices. Proponents of the law, however, have just as stoutly maintained that there have been no increases.

Retail druggists are not the only independents forming protective organizations, for we read of the formation of another New York State Association, the purpose of which is to conduct a state-wide campaign against "unfair competition" from chain stores. The organization is known as "The Empire State Independent Retailers and Wholesalers Association" with offices at 11 East 42nd Street, and a membership of approximately 200 made up chiefly of retailers and jobbers in the grocery industry. The Association states that Samuel Untermyer is acting as special counsel and that under Mr. Untermyer's direction studies are being made of anti-chain store legislation throughout the country with an idea of incorporating sections from different state laws into a statute for New York. Victor H. Lawn, Executive Secretary of the new group, contended that "Every time a chain store opens in a neighborhood, four independent dealers have been put out of business." In addition to national legislation a number of state pharmaceutical and other independent retail merchants' associations in various states are endeavoring to enact anti-chain store legislation of the Louisiana type.

Apparently the Robinson-Patman Act and the Miller-Tydings bill will not mark the end of enacted and proposed legislation designed to aid the independent. On August 2nd, Representative Wright Patman, of Texas, co-author of the Robinson-Patman price discrimination law, announced that he is drafting a bill to prohibit a company from owning stock directly or indirectly in retail stores or banks in more than one state.

The voluntary chain idea does not seem to have possessed the same attraction to retail druggists that it has to retail grocers and it would seem that they might advantageously study the method of operation.

The "voluntaries" have demonstrated their value as a highly efficient agency, enjoying in addition a protected position under various state store tax laws. Interest in this type of organization grows among the corporate chains as they are pressed increasingly by hostile state laws.

While independents and those sympathetic to their cause are endeavoring to improve the position of the small business man, friends of the chains are not remaining inactive and we read that "Manufacturers who sell to chain stores, particularly those of the variety type, are being urged by the newly organized American Manufacturers' Institute, with headquarters at 200 Fifth Avenue, New York City, to join in a fight against "unjust" taxation of chain stores. The new organization claims to be independent of chain stores' interests and states that its purpose is to fight discriminatory taxation and to work with governmental agencies in the planning and development of further social and economic programs free from burdensome taxation and unreasonable group demands.

In the final analysis, perhaps the most important phase of the chain *versus* independent store is the social side of the question, and this is the phase with which the consumer is vitally interested. Merchants large and small must be willing to step aside in the public interest if they cannot compete with the stronger competitor who conducts his business honestly and fairly. They must remember that the consumer's interest is greater than their individual welfare. It is up to the independents to tell the consumer their side of the story.

THE DEPARTMENT OF THE AMERICAN ASSOCIATION OF COLLEGES OF PHARMACY

The Publication Board

RUFUS A. LYMAN, *Chairman and Editor.* ZADA M. COOPER, *Secretary.*
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IF ONE basic field in pharmaceutical education can be said to have been neglected more than another, that field is the biological field. In this field pharmaceutical education has not kept pace with pharmaceutical practice and for that reason biologic assay went to the medically trained man and not to the pharmaceutically trained individual, where it, by the nature of things, belongs. The Commonwealth Study of pharmacy showed physiology to be a basic pharmaceutical science and it took the strong hand of the Director of that study to keep certain members of the advisory committee from eliminating physiology from the pharmaceutical curriculum. The same sentiment was evident in the committee that made the last revision of the Pharmaceutical Syllabus. With the inclusion in the Pharmacopœia of a number of biologic assays and with the whole field of medicine headed in that direction, for the Syllabus Committee to vote against making biologic assay a requirement in the curriculum, was nothing less than a tragedy, it was a pathetic calamity. It was all the more pathetic, not because the Committee did not see the vision, it was done for fear it would add to the expense of teaching in some schools which could not afford it. When a school reaches that point, it better give up trying to give courses in the pharmaceutical sciences and devote its energies to the teaching in elementary bookkeeping and penmanship. It is therefore tremendously refreshing to find a man like Dr. R. A. Deno of the School of Pharmacy of the Medical College of Virginia who is giving thought to the most basic of the basic biological sciences and is actually working out his thought in his own laboratory.

Forty years ago, or at an even later date, pharmacy was an isolated science. A College of Pharmacy was looked upon as a one-subject college. That condition is changed, no longer can we think of pharmacy in the terms of one subject, or in relation to physics and chemistry alone, it must also be thought of in its relation to botany, zoölogy, physiology, pharmacology, biologic assay, pharmacognosy and bacteriology. These subjects are just as rightfully called the pharmaceutical sciences as they are entitled to be called the medical sciences.

Not only the pharmaceutical educator, but the research worker and the practicing druggist will appreciate the stress Doctor Deno has placed upon a more basic teaching of biological science in the pharmaceutical curriculum.—RUFUS A. LYMAN, *Editor.*

THE TEACHING OF BIOLOGY TO PHARMACY STUDENTS.

RICHARD A. DENO.*

Courses in pharmacy almost always have included instruction in the science of botany. More recently, general work in zoölogy has been required in an increasing number of colleges. This requirement is logical when we consider the rapid development within recent years of gland products and other pharmaceuticals of animal origin, and the present-day emphasis upon courses that are cognate to the work in pharmacy proper and whose nature is biological. At the present time a few schools of pharmacy are requiring a year of biology in place of botany, or of botany and zoölogy. In view of these changes and of the present extensive discussion of the cultural aspects of professional education, it might be well to ask a few specific bio-pharmaceutical questions.

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Should beginning students in pharmacy be required to take botany? If so, what kind of course should be offered: the so-called pharmaceutical botany, the type-form life-cycle botany now taught in many colleges of liberal arts as it has been for several decades, or the principles-type wherein a considerable emphasis is placed upon subject-matter other than morphology? Should zoölogy be given a place in the pharmacy curriculum? If so, what nature should this work assume: the traditional one with its emphasis upon the dissection of type-forms, a survey course devoted to the study of principles, or a hybrid zoölogy which attempts to include the virtues of both of these types? If a semester of general botany and one of general zoölogy are found advisable, will it be more advantageous to combine them as a year of general biology? And if this is done, what lines should this follow: emphasis on morphology, or upon principles? Is it possible that the pharmacy curriculum would be strengthened by the addition of advanced courses in zoölogy designed to furnish a basis for a better understanding of physiology, pharmacology, biological assaying and biochemistry, and by advanced work in botany preparatory to pharmacognosy and drug analysis? If some of the pharmacists of the future are to be trained as plant chemists, or as scientists capable of rendering effective technical aid to hospitals and to other public health agencies, what specialized courses in biology would best fit them for this type of service? As a pharmacist and a biologist, knowing some of the problems of pharmacy and some of the contributions which biology has to offer, I humbly suggest a few possibilities in answer to these questions.

The teaching of botany to beginning pharmacy students is so universal, and the relation of this discipline to the vegetable drugs is so obvious, that its inclusion needs no further justification. The question here is: what lines should botanical instruction follow? Many believe that students in pharmacy are benefited most by a course in pharmaceutical botany, where particular emphasis is placed upon plant parts used in medicines, their microscopic anatomy, and upon laboratory procedures designed to teach the student how to prepare these parts for study. In supporting the teaching of pharmaceutical botany in a recent thoughtful article the statement was made that, "For the pharmacist, however, it (botany) becomes more than purely a cultural attainment, for he is interested in applying his knowledge in specific cases in order to safeguard his reputation in business by being able to judge accurately his crude drug materials" (1). I cannot see how certain phases of botany can be emphasized while others are minimized or omitted, and the pharmaceutical botany which has been developed in this manner then spoken of as *more* than a purely cultural attainment. I believe it is *less* than a purely cultural attainment, a narrower, albeit more proficient, one. Such early specialization of the field means that pharmaceutical botany is really elementary pharmacognosy. If one believes that early and repeated emphasis upon this receding field in pharmacy is more important than a broader training in plant science, then pharmaceutical botany is justified. I cannot subscribe to this belief.

If general botany is given instead of pharmaceutical, the sort best designed to fit the needs of the pharmacy student should be considered. Traditional courses are of the type-form, life-cycle variety. This method of presentation magnifies some of the objections to general botany mentioned in the article referred to previously. Emphasis is placed upon typical life cycles of the various plant groups and

the balance of the time is devoted principally to morphology. Usually there is little time left for a consideration of other phases of the subject.

A number of colleges of liberal arts have recently adopted the principles approach to the subject. Courses following this procedure are in the nature of survey courses in which an attempt is made to enter as many of the fields of plant science as it seems practical to introduce to beginners. In addition to the cytology and histology of plant organs, classification and typical life-cycles, attention is given to plant physiology, ecology, heredity, geography and evolution. These latter phases are seldom dealt with in pharmaceutical botany and frequently receive slight attention in the type-form, life-cycle botany. Many believe that such phases have no place in beginning botany, but if the course is designated general, as most are, such topics are properly included. Others admit the logic of including these branches in the general course, but state that time does not permit their treatment adequately, that the full session is needed to present the elements of morphology and classification. Such courses should not be designated as general; they should be called what they are: elementary morphology and classification of plants. It is possible to cover the traditional fields, if one is content to omit certain details, and still find time for the other important topics. If botany is to be taught apart from zoölogy, I believe that for all students, including those in pharmacy, the principles method is the best approach.

There is no such unanimous agreement among pharmaceutical educators respecting the place of zoölogy in the pharmacy curriculum as is found for botany. Many still expect their students to master physiology and to learn in its applied branch, pharmacology, how drugs produce their effect in the body without even the rudiments of form and function given in general zoölogy. From a practical angle, in America the pharmacist is the dispenser of contraceptive merchandise, yet in most instances he has no scientific training in the anatomy and physiology of sex. In many schools pharmacy students are expected to understand biochemistry without any preliminary training in one of its basic subjects, zoölogy. The Pharmaceutical Syllabus requires instruction in public health studies with no biological requirement prerequisite. The same book suggests a course in biological assaying for students who may or may not know anything about the animal organism, and one in insecticides for those who very probably do not know the difference between a bug, an insect and a spider. Each of these instances is like expecting a student to do well in quantitative analysis without training in general chemistry. Such a procedure would provoke instantaneous disapproval, yet some of our best schools are following exactly the same fallacy in regard to the advanced courses which are grounded in zoölogy. The curriculum is top-heavy in this respect, and even those not trained in animal biology should be able to recognize this deficiency.

The kind of zoölogy which best meets the needs of the pharmacy student may now be considered. Here again, the traditional course is of the type-form variety, in which representative animals are dissected and their minute anatomy learned. Many of these are marine forms whose existence should be known but whose morphology is of slight concern to a practicing pharmacist. This older grasshopper-zoölogy does not give the pharmacy student what he needs.

The principles-type of biology furnishes a broader basis for advanced work, and is better suited as a prerequisite for the pharmaceutical subjects based on

zoölogy. Here many aspects of zoölogy are noted: form, function, embryology, heredity, classification, ecology, geography and evolution. By omitting some of the details of anatomy it is possible to introduce many phases of the subject never covered in the older courses.

There have been attempts made to revise the older zoölogy. In these courses type-forms are still emphasized in laboratory and the other phases considered theoretically. This hybrid zoölogy is not very satisfactory to the champions of either method. Laboratory work is highly desirable for all phases studied in the recitation hall, and a compromise between the two methods is difficult to effect.

If one believes that general botany and general zoölogy are of value to the student of pharmacy, a logical query is: how much of each? Another pertinent question arises: could they be given better as one course, biology? To answer the first question, I believe that one semester of general work in each is adequate for our needs. There is at least one dean who feels that a year of each should be required. Instead of this, a semester of each and an additional semester of specialized work in botany and one in zoölogy would be more valuable in pharmacy.

The substitution of a year in biology for a semester of botany and one of zoölogy has much to recommend its serious consideration. For beginning students, the similarities between life processes in plants and animals are more important than the differences. Cell structure and function are alike in plant and animal. Reproduction in the two is a parallel study. The laws of heredity are identical in the two disciplines. The principles of classification hold true for both. Geography, paleontology and evolution are best learned when plants and animals are considered simultaneously. It is utterly impossible to discuss animal ecology without constant reference to plants. In fact, if one is to include anything other than the structural details of type-forms, plants and animals are studied better together than separately.

From what has been said it can be seen that in the writer's opinion the needs of a pharmacist can best be filled by an introductory course in the principles of biology given throughout the freshman year. If this is done, time will allow an adequate discussion of the neglected phases in addition to ample treatment of the conventional aspects of botany and zoölogy. From personal experience I believe that a gain in time of about one-third of the academic year can be made by treating the two subjects together in their many similar phases. This means that more free time is available for the neglected fields.

A year of general biology of such comprehensive scope cannot include sufficient details entirely to prepare the student for physiology, pharmacology and biochemistry on the one hand, and pharmacognosy and drug analysis on the other. Neither does general zoölogy nor general botany properly pave the way for these specialized courses. A semester of sophomore zoölogy and one of sophomore botany following a year of substantial work in general biology will, however, give a basis comparable to that now given for advanced work in chemistry.

The semester of advanced zoölogy should consist of a study of the gross anatomy and histology of vertebrates, with enough embryology included to give an adequate conception of the origin of the endocrine glands. The laboratory work might well be centered on the cat, with a preliminary study of the dogfish as typifying the vertebrate plan of structure. A histological study of the organs should

parallel the gross dissection. With the anatomy of the cat clearly in mind, the student would be prepared to understand the work given later in physiology, pharmacology and biochemistry.

The semester of advanced botany should consist of much of the morphology now given in pharmaceutical botany, and might well include enough plant physiology and ecology to furnish a background for work in drug analysis, plant chemistry and the culture of medicinal plants. This should equip the student adequately for advanced work in pharmacognosy.

The two years of biology that have been outlined are needed at the present time to give a biological basis for an understanding of the junior and senior courses now present in the pharmaceutical curriculum. If, as some believe, the pharmacist of the future is to be trained to give technical service to hospitals and other public health agencies, it may be necessary to require courses in microtechnique and parasitology. If some are to qualify as specialists in the field of drug plants, they should receive additional training in plant physiology and plant ecology. For the present, however, the needs can be met by two years of biological training along the lines suggested, but not by less.

Up to this point I have purposely avoided any reference to the cultural aspects of biology. No one denies the cultural value of botany and zoölogy, or of pharmacognosy and pharmacology for that matter, but few have attempted to tell what they mean by cultural value. At recent conferences attended by national leaders in the field of professional education, engineers, pharmacists, dentists, physicians and lawyers, there has been much thoughtful discussion of the need for a cultural approach to vocational education. Here again these men find it difficult to explain what they mean by a cultural approach.

If by culture we mean what Mathew Arnold meant, the acquainting ourselves with the best that has been known and said in the world, we find ample reason for including the neglected aspects of biology in our principles course. A student who has finished biology should be acquainted with the work of Mendel and his modern successors in the field of genetics. To complete his course and know nothing of what the names Lamarck, Wallace, Darwin and Huxley stand for certainly is not acquainting himself with the best that has been known and said on a topic of vital interest.

If by culture we mean the training and refinement of mind, tastes and manners which comes from contact with persons of similar training and refinement, the problem is slightly different. The need here is for a more careful selection of teachers, for a finer regard for these qualities in those with whom our students come in contact. If a teacher is of such character that he inspires emulation of his personal traits and habits, it matters little in what discipline he instructs.

Whichever meaning is applied, the biological sciences are definitely cultural. None can be held conversant with the broad aspects of science who does not understand the workings of the animal body or something of the world of plants. In many phases of biology, a teacher of refined nature is essential if the facts are to be presented in their true light and seen in their relationship to the pattern of life as a whole. Perhaps still different meanings are implied by others in speaking of culture, but until a more specific application of the term to vocational training is given, many will continue to think of cultural aspects as here depicted.

To carry out a program designed to strengthen the pharmacy curriculum at one of its weakest points—deficiency in biological groundwork—there are certain specific needs. The courses required must be adequately given, not by professors of pharmacy, not by instructors in pharmacognosy, not by chemists, but by trained biologists, preferably with an understanding of pharmacy. The courses cannot be given adequately without a sufficient allotment of time for recitation and laboratory. For the two years of biology outlined, three hours of recitation and six hours of laboratory instruction each week are needed. They cannot be given without proper equipment and supplies. A principles course in biology requires more material for proper presentation than does the type-form dissection type, which may be one reason why some have opposed the adoption of the principles method.

To summarize briefly, one of the weakest points in our present pharmacy curriculum is the lack of adequate training in the biological sciences. Much of the rote memory work in certain advanced courses is traceable directly to this deficiency. What a student does not understand he must memorize if he is to pass the course. The remedy consists in the introduction of a year of general biology, preferably of the principles-type, followed by a semester of vertebrate anatomy and histology, and one of plant morphology and physiology. The arguments in favor of a freshman and a sophomore year of biology are of two types, the need of this groundwork for an understanding study of advanced subjects, and the less tangible but no less real cultural gains to be obtained from biology. Until pharmaceutical educators recognize the need for and are ready to introduce substantial work in biology, in many courses the upper-class students will continue to memorize rather than understand, and the curriculum as a whole will have a vital weakness in its foundation.

REFERENCE.

(1) Hiner, L. D., *A. J. Pharm. Ed.*, 1, 132 (1937).

PHARMACY WEEK RADIO TALK.

BY PROF. EDMUND N. GATHERCOAL.*

Good Evening Folks:

Pharmacy Week has returned again; does it have any meaning to you? Most folks think that a pharmacy is a high-brow drug store; perhaps you are right. But please remember this—every drug store is a pharmacy or contains a pharmacy within it; for a pharmacy is a place where drugs are prepared, sold and dispensed.

As we look at the usual corner drug store we know that much of its stock in trade and of its activities are not those of the pharmacy. We will admit that the soda fountain with its lunch counter must be excluded from the pharmacy. Surely the magazine and newspaper stands, the circulating library, the toy counters, the tobacco cases, the candies—all of these cannot be a part of the pharmacy. Oddly enough, however, quite a few medicines are dispensed over the soda counter. It is not unusual to see persons consuming fizzing headache remedies, doses of castor oil disguised in sarsaparilla soda, and mild laxatives such as citrate of magnesia and Seidlitz powders.

Please remember also that all drug stores do not have soda fountains. For example, there are listed in the 1930 national census some 1600 drug stores in Chicago, but 381 of these do not have soda fountains.

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* President of the AMERICAN PHARMACEUTICAL ASSOCIATION, over WEAF and network, Monday, October 18, 6:15 to 6:30 P.M. E.S.T.

In the national Pure Food and Drug Law discussed by the present Congress, the definition states that all substances, preparations and devices intended for use in the cure, mitigation, treatment, diagnosis or prevention of disease in man or other animals are drugs. Notice how broad this definition is. It includes not only the medicines taken by mouth, but the pastes and salves applied to the skin; the sprays and jellies applied to the mucus membrane; the solutions injected beneath the skin; the cottons, bandages and gauzes used in connection with wounds; disinfectants of all types; surgical instruments, crutches and wheel chairs; and all kinds of articles used in the sick room.

You will note, therefore, that all drugs are not contained in bottles on the pharmacist's shelves. Many folks are quite surprised at this broad legal definition of a drug. The next time that you look about in the drug store, just bear in mind that many of the items you may look upon as ordinary merchandise are in reality essential for the sick room and are defined as drugs.

It is interesting to note also that many articles of food and other articles that occupy an important place in our economic life also serve as drugs. For instance, iron is a very valuable and extensively used drug. I will admit, however, that its use as a drug is infinitesimal compared with its economic use. Rubber is an important item in many sick-room supplies, in the production of plasters and bandages, etc.; but its use in medicine, while very important, is small in comparison with its use in automobile tires. Sugar is a very important item in many medicines. Alcohol has a wide use in medicine, and yet we certainly would not include the sale of wines, beers and liquors for beverage purposes in the province of the pharmacy.

Your druggist is a highly trained professional man, with a great responsibility to the sick.

In nearly all of the states of our country, he is required by law not only to complete his high school education with a high standing, but to complete four years of college training in the sciences pertaining to pharmacy. These colleges of pharmacy are found widely scattered over the United States, some sixty in all, and are listed as institutions of higher learning. In the west and middle west they are mostly an integral part of their state universities; in the east they may be connected with endowed universities or they may be independent schools of pharmacy. Many students in pharmacy continue their education until they obtain the highest university degrees.

In addition to his college education, the future pharmacist must also take from one to three years of technical training in the drug store. In years gone by, before the extensive college education was required, this training was carefully supervised by the senior pharmacist in the store. In the present day this apprentice training has lost some of its earlier significance.

After completing the educational and training requirements, if the young man or woman be a citizen of the United States, and of good moral character, he is admitted to the licensing examination. This examination covers such subjects as chemistry, physics, botany, zoölogy, bacteriology, physiology, pharmacology, materia medica, and most important of all, prescription compounding and practical pharmacy. If he is successful in the examination, he is registered and licensed to practice. This license is transferable to most of the other states of the union. In most states it must be renewed annually. It is revocable for gross immorality, criminality or criminal carelessness in the practice of pharmacy.

The pharmacist is required by law in many of the states to keep his pharmacy in a clean and orderly condition, properly equipped and stocked for the dispensing of medicine, and with a suitable library. His pharmacy is subject to inspection at any time during business hours.

The responsibility of the pharmacist to the public is very great. The pharmacist only is permitted to dispense poisonous, dangerous or narcotic drugs and he must assume full responsibility therefore. He is responsible for the doses of all medicines that he dispenses and if the physician wishes to prescribe unusual doses he must so state on the prescription. Most medicines are poisons when consumed in excessive doses. It has been said, "A dose is enough, a poison is too much."

The pharmacist is also responsible for the identity and the purity of the medicines that he dispenses. Likewise, he must be accurate in his dispensing. A five-grain capsule of quinine must contain just five grains of the drug. Four and one-half grains will not do, neither will five and one-half grains. The law, as representing the public, is constantly checking and inspecting the pharmacist in all of his activities.

We have given considerable attention to the qualifications and responsibilities of the pharmacist and his pharmacy that you might know that when you present your prescription or place your order for medicines you are dealing with a highly professional man in keeping with the

professional man who writes the prescription. With most pharmacists the professional training is predominant, though the commercial side is also evident; occasionally there is one where the commercial side is predominant.

Pharmacy is as old as the human race. It has occupied an important place in history and has been of great public value since the 16th century before Christ, about the time of Moses. As a profession, pharmacy far outdates medicine.

Plants and animals yielded the first medicines. Some of these, used thousands of years ago, are still considered valuable medicines and are extensively used. Myrrh, cinnamon, calamus and olive oil go back to the earliest Scriptures; the use as drugs of opium, aloes, gum agar, marshmallow, bitter almonds, anise, licorice, pepper, chinese rhubarb, wormseed and many other items dates back to the earliest historical writings.

The use of minerals and chemicals in medicine is of much later origin. The alchemists of Arabia and Europe from the tenth to the sixteenth centuries A.D., slowly introduced chemicals that have become useful drugs. The herbalists and the alchemists of an earlier date were the forerunners of the modern pharmacists.

As pharmacy plays such an important part in human affairs and as the pharmacist comes daily into the most intimate contact with the public, he witnesses a cross section of humanity, perhaps in better manner than one from any other group of individuals.

A community without a drug store is about as useful as a cart without a horse. Many communities throughout our country have been built up around a daring pioneer who braved want and privation by setting up a drug store at a crossroads where the circuit-riding physician could replenish his bag or send a scurrying messenger in time of need. The drug store is an important factor of every progressive community.

The advancement of a community can be materially measured by the commercial progress and the professional standing of its drug stores. The profession of pharmacy is ever advancing further into the old scientific fields and also into many new scientific fields. This is reflected in the present-day pharmacy.

The highly professional type of pharmacy, free from the commercial lines, and serving the physician and the public exclusively from the pharmaceutical standpoint, has been customary throughout Europe for centuries. In America this type of store is not so common, because of the pioneering nature of the druggist. When he goes into a small community the volume of drug business is so small that the store cannot be maintained unless the volume of business be much increased, hence, the many commercial lines in the drug store. Furthermore, the small community is very glad to have the druggist carry these many different articles, in order that they may be obtained in the community.

In the larger cities and towns of to-day, however, the professional type of pharmacy is rapidly making its appearance. The physicians are pleased because of the highly professional services rendered. The public is pleased because of absolute assurance regarding the compounding of prescriptions in the most perfect manner and with fresh, pure, proper drugs. As our nation becomes more settled and our communities older and better established, this type of pharmacy will become more widely extended.

America is well served by its pharmacists; better, perhaps, than any country in the world. Every village of a few hundred inhabitants has its pharmacist. When the village becomes a small city of a thousand or so, there are two drug stores, so that competition leads to better service. Sixty thousand drug stores serve America, one for about each two thousand population; one for about each three physicians and a little more than one for each dentist.

Referring back to the definition for a drug, we find that the pharmacist is concerned in the prevention of disease as well as in the treatment, mitigation and cure of disease. The whole medical group, including physician, dentist and pharmacist, has produced most remarkable results in America by their efforts to *prevent* disease rather than wait until treatment was necessary. A century ago the average length of life in this country was less than thirty years; to-day it almost reaches sixty years. This remarkable change has been largely accomplished by the wonderful development of sanitation, by pure food and milk regulations, by the development and use of vaccines and antitoxins and by numerous other means for preventing disease. It has been estimated by some, that this great medical group devotes at least as much of its time, energy and ability to the prevention of disease as it does to the cure of disease.

Pharmacy has played its full part in these great accomplishments. It has been active in the development of vaccines, toxins and antitoxins. It has entered into the discoveries as to the valuable properties of the vitamins and has standardized these in cod liver oil and in other substances. It has taken a part in the discovery of the hormones from the animal glands; in their separation, purification and preparation into suitable medicines. It certainly has played a large part in the development of disinfectants and antiseptics and in their standardization. Even this year pharmacy has developed a new prophylactic (an agent that prevents disease) for syphilis which may play an important part in the elimination of this dread disease from America.

In the midst of this Pharmacy Week, please give thoughtful attention to the professional service rendered to you personally, to your community and to your state and nation by your pharmacist. Encourage him to develop the professional side of his business. He is entitled to the same respect as the other professional men who touch your life.

Good-bye until Pharmacy Week next year.

REMINGTON MEDAL AWARD FOR 1937.

The award of the Remington Medal for 1937 was made on October 25th, at Pennsylvania Hotel, New York City, at a testimonial dinner, honoring Dr. J. Leon Lascoff. The interesting program was carried out at a special meeting of the New York Branch of the A. PH. A.; President F. C. A. Schaefer of the New York Branch presided as toastmaster.

Dr. Harlan H. Horner, Associate Commissioner for Higher Education, University of State of New York, spoke on "Lascoff, the State Board Member;" Dr. Robert L. Swain, past-president of the A. PH. A., on "Lascoff, the Association Man;" and Dr. Cary Eggleston, Cornell University Medical School, on "Lascoff and the Medical Profession."

A first copy of the Pharmaceutical Recipe Book, Second Edition, was presented to Dr. Lascoff, as a memento of his splendid work on this publication, by Secretary E. F. Kelly, of the A. PH. A. On behalf of a large number of his friends from all over the country, Mr. Jerry McQuade presented Dr. Lascoff with a handsomely bound volume containing messages of congratulations and best wishes from these friends. In addition a number of letters and telegrams were read by President Schaefer.

J. LEON LASCOFF—THE 17TH REMINGTON MEDALIST.

J. Leon Lascoff, Remington Medalist.

Inscription on Remington Medal.

Joseph P. Remington—Face of Medal.

The Remington Medal was formally presented to Dr. Lascoff by Dr. Curt P. Wimmer, past-president of the New York Branch, and the recipient responded in an address, reviewing his experiences as a practicing pharmacist and expressing the conviction that professional pharmacy has a brighter future than heretofore for those practitioners who serve it as a public health profession and in real coöperation with the other branches of medicine. Publication of the addresses will have to be deferred.

About four hundred and fifty members and friends participated in the delightful function.

LOCAL BRANCHES

CHICAGO.

The 245th meeting of the Chicago Branch of the AMERICAN PHARMACEUTICAL ASSOCIATION was convened at 8:00 P.M. on October 19, 1937, with President H. M. Emig presiding. The first order of business was the report of the Delegate to the 85th annual convention held at New York City, August 17th–21st. It is of interest to note that twenty members of the Chicago Branch and sixteen wives and guests were in attendance.

A brief report of Mr. Samuel Shkolnik covering the N. A. R. D. Convention, held in St. Louis, during the week of September 27th, followed. Mr. Shkolnik discussed the activities of this meeting pointing out the importance of the Fair Trade program.

The speaker of the evening was Dr. Frank B. Kirby, Educational Director of Abbott Laboratories. Dr. Kirby has lately returned from a three-month stay in England. Entitling his speech, "Pharmaceutical-Medical Observations from Over the Seas," Dr. Kirby told of his experiences in London and English traffic and in visiting various historical spots. Of particular interest was his description of the curriculum of the English Pharmacy Colleges and the activity of the British Pharmaceutical Society; a description of the Royal College of Surgeons, and the Royal College of Physicians, and of certain London Hospitals and their methods of treatment. The panel system of medicine and its pharmaceutical relationship were also outlined. One of the most interesting points discussed was the restriction of sales in retail outlets to drugs after the hour of 9:00 P.M.

Apothecaries Hall and its history was described in some detail, tracing its influence through the period from its founding in 1617 to the present date. A description of Apothecaries Hall Botanical Garden founded in 1673 was compared with the Kew Gardens and the medicinal plant gardens of United States. The introduction of medicinal plants into other countries through the agency of the Apothecaries Hall Garden was described, such as cotton to the United States, tea plants into Ceylon, and cinchona into the East Indies. Dr. Kirby outlined his plan for the starting of a medicinal plant garden in the Chicago Park system, pledging his support and leadership in this matter. Briefly mentioning his experiences in Paris, Dr. Kirby exhibited a poster showing the courses given at the Pharmacy College of the University of Paris.

RALPH E. TERRY, *Secretary*.

PHILADELPHIA.

The October meeting of the Philadelphia Branch, A. PH. A., was held on Tuesday evening, October 12th, in the Auditorium of the Philadelphia College of Pharmacy and Science, 43rd Street and Kingsessing Avenue. The meeting was called to order by President Kendig who, on the occasion of the first meeting of the 1937–1938 season, asked for the coöperation of the membership in furthering the work of the Branch; particularly to increase the membership.

Chairman Kerlin, of the Membership Committee, presented the name of Dr. Russell Cain, who was unanimously elected to membership.

Professor Eby, Chairman of the Program Committee, reported that plans are already complete for several meetings of the season and that plans for other meetings are being considered.

Dr. Ambrose Hunsberger, Delegate to the House of Delegates, presented a very comprehensive and very interesting report on the A. PH. A. Convention in New York.

The secretary reported that a ruling had been obtained from Secretary Kelly to the effect that Branches of the A. PH. A. may not elect to active membership in any Branch persons who are not members of the A. PH. A. in good standing. Branches may, however, elect non-members of the parent body to Associate Membership in a Branch but these members shall not have the right to vote. It was moved by Dr. Hunsberger, seconded by Dr. Munch that a Committee be appointed to revise the By-Laws of the Branch to conform with this ruling.

President Kendig introduced Dr. Arthur Osol of the Philadelphia College of Pharmacy and Science who delivered a very interesting and informative address on "p_H and Osmotic Pressure with Special Reference to Ophthalmic Solutions." Professor Adley Nichols explained the pharmaceutical applications of the subject, and an interesting open discussion followed.

ARTHUR K. LEBERKNIGHT, *Secretary*.

EDITORIAL NOTES

A CORRECTION.

We are just advised by the authors of "The Effect of Cystine on the Toxicity and Trypanocidal Activity of Neoarsphenamine," published on page 497 of the June 1937 JOURNAL, that certain errors were overlooked when they prepared the manuscript, and therefore they have requested us to publish the following corrections:

On page 500 in Fig. 1—the curve designated as representing the results obtained with 500 mg. of cystine is, in fact, the curve representing the control experiments, whereas the curve designated as representing the control experiments actually describes those obtained with 500 mg. of cystine.

In Fig. 3—the dosage of neoarsphenamine was 7.5 mg. and 5.0 mg. and not two 7.5 mg. doses.

In Fig. 4—the dosage of neoarsphenamine was 9.0 mg. and 7.5 mg. and not two 9.0 mg. doses. Also in Fig. 4—the percentage of trypanosome infected animals surviving after 27 days, having received one 9.0 mg. and one 7.5 mg. dose of neoarsphenamine and 250 mg. doses of cystine, is 57% and not 43% as shown in the curve.

ANNUAL CENSUS OF PHARMACY BY THE NATIONAL ASSOCIATION BOARDS OF PHARMACY.

BY H. C. CHRISTENSEN, SECRETARY.

During the calendar year 1936, the boards of pharmacy of the 48 states and the District of Columbia registered *3096* pharmacists by examination. This represents the new blood entering the profession and includes no reciprocal registrations, as the latter represent a redistribution of pharmacists already on the roster.

In a paper read at the New York convention of the AMERICAN PHARMACEUTICAL ASSOCIATION (Section on Education and Legislation—1937) Secretary E. F. Kelly estimated the necessary replacement figure at from 3 to 3½% of the total of 100,000 pharmacists. Thus the 1936 figure on board registrations amply covers the replacements, but makes no allowance for further expansion.

The Census of Pharmacy students tabulated from questionnaires submitted by 69 colleges of pharmacy receiving board recognition gives the total enrollment of *8424* pharmacy students as of June 1937. This is an increase of 240 over the census of students taken in 1936, when the enrollment was only *8184* thus reflecting a 3% increase in pharmacy college enrollment.

The American Association of Colleges of Pharmacy announced a six per cent decrease in freshman enrollment in its member institutions for the school year 1936–1937, and the figures compiled by the N. A. B. P. on *all* the schools show a like decrease, perhaps even a little higher, on freshman enrollment. Some schools did not furnish detailed figures classified by years so actual count cannot be given.

How can the total enrollment increase when the freshmen count decreases? This is a seeming contradiction. The answer lies in the number of transfer students accepted in the sophomore and later years. In a state university, for example, it is not unusual for a student to take liberal arts, chemistry, engineering or other branches and then get interested in pharmacy and transfer during the second or even subsequent years. He is given the "advance standing" his credits rate and is therefore not included in the freshman count, although he is a *new* student in pharmacy.

To give a concrete example: One state university showed a freshman enrollment in 1933 of only 15. In 1937, however, the senior enrollment was 49, in spite of the fact that only 9 of the original freshman class were promoted to the sophomore year. The difference represents the transfer students. This example is used to show that the freshman enrollment is not always a reliable index as to the number that will be graduated four years later, even after allowance for drop-outs is given consideration.

The growing demand for pharmacists in the United States, sometimes termed a "shortage," should be no cause for alarm on the basis of statistics in an article in the *Pharmaceutical Journal of Great Britain*, Sept. 11, 1937, page 289. Quoting from that article:

"In the event of the number of entrants to pharmacy showing in future years no increase above the present low rate, it seems that the necessity for legislation aimed at the limitation of pharmacies will not arise. As the supply of managers and qualified assistants diminishes,

so their basic salaries are bound to get higher, and in consequence their natural urge to open in business on their own account will lessen."

In Great Britain, there is only one pharmacy for every 2900 persons, whereas in the United States there is one pharmacy for every 2200 persons. In Great Britain there is more than one physician to every thousand of population and only one pharmacist to every 2130 persons. In the United States (using population estimate of 125,000,000 and estimates of 100,000 pharmacists and 165,000 physicians) there is one doctor to every 760 persons and one pharmacist to every 1250 persons. Or, in Great Britain, the ratio is 2 to 1; in the U. S., 1.65 to 1, the first figure representing the physician, the second the pharmacist.

British medical journals have cited that there is a real risk of an overstocked medical profession. The *British Pharmaceutical Journal* article continues, "The same remark, we believe, applies to pharmacy. In our problem, however, pharmaceutical overpopulation is probably more applicable to certain areas than to the country as a whole."

This comparison is interesting as the British system of training, education and registration of pharmacists has often been cited as a good example to follow. On that basis, the United States would need only 83,000 pharmacists to serve 165,000 physicians. The different conditions existing in the United States, however, particularly geographical, may require a greater number of pharmacists. There is no measuring stick.

According to figures given by the Bureau of Census in the Fifteenth Census of Population, Volume V, Occupations, there were 104,727 "Druggists and Pharmacists" in the United States in 1930. In 1920, a comparative figure of 80,157 is given; in 1910, the figure is only 67,575. The N. A. B. P. count of 100,000 for 1935 is an estimate based on questionnaire returns from the boards of pharmacy. There is no doubt that there was a shrinkage of 5000 during these five intervening depression years. The government census figures show a considerable increase in the number of pharmacists from 1910 to 1930 (about 37,000) so there is some basis for believing that perhaps the saturation point has been reached. It may be wise to remain strictly on a replacement basis until such time when further expansion warrants an increase in the number of pharmacists. Undoubtedly the old law of supply and demand will accomplish that.

NEW AND NONOFFICIAL REMEDIES.

THE FOLLOWING ADDITIONAL ARTICLES HAVE BEEN ACCEPTED AS CONFORMING TO THE RULES OF THE COUNCIL ON PHARMACY AND CHEMISTRY OF THE AMERICAN MEDICAL ASSOCIATION FOR ADMISSION TO NEW AND NONOFFICIAL REMEDIES. A COPY OF THE RULES ON WHICH THE COUNCIL BASES ITS ACTION WILL BE SENT ON APPLICATION.—PAUL NICHOLAS LEECH, *Secretary*.

PROPADRINE HYDROCHLORIDE.—*dl*-Phenyl-1-amino-2-propanol-1-hydrochloride.—*α*-hydroxy-*β*-amino-propylbenzene hydrochloride.—$C_6H_5.CHOH.CHNH_2.CH_3.HCl$. Propadrine hydrochloride is the monohydrochloride of a base resembling ephedrine (*laevo*-*α*-hydroxy-*β*-methyl-amino-propylbenzene) but differs in that the methyl group on the amino group is replaced by a hydrogen atom.

Actions and Uses.—Propadrine hydrochloride acts similarly to ephedrine. When applied locally, in the form of a 1 per cent aqueous solution or 0.66 per cent jelly, it produces constriction of the capillaries, thereby shrinking the swollen mucous membranes. It is said that its action is somewhat more prolonged than that of ephedrine. It is also claimed that the anxiety complex is not so apt to ensue with propadrine hydrochloride as with ephedrine.

Dosage.—As a spray or instillation, 1 per cent aqueous solution or application of 0.66 per cent jelly locally; orally, as three-eighths grain capsule every two to four hours as indicated. Although no toxic effects have been noted, continued overdosage should be avoided as with other vasoconstrictors.

Propadrine hydrochloride occurs as a white, crystalline powder, possessing an odor resembling that of benzoic acid. It is freely soluble in water and alcohol; insoluble in ether, chloroform and benzene. Its aqueous solution is neutral to litmus. Propadrine hydrochloride melts at 190°–194° C.

Dissolve about 0.5 Gm. of propadrine hydrochloride in 25 cc. of water and add 5 cc. of a saturated solution of sodium carbonate. Cool in an ice bath and collect the resultant needle-shaped crystals on a filter paper, wash and dry at 80° C.: the melting point of the *α*-hydroxy-*β*-amino-propylbenzene is 101°–101.5° C.

Dissolve 0.05 Gm. of propadrine hydrochloride in 100 cc. of water: separate portions of 2 cc. yield a yellow color with 5 drops of a 9 per cent ferric chloride solution (*distinction from cobefrin, kephrine, epinephrine*); no precipitate with potassium mercuric iodide solution (Mayer's reagent) (*distinction from benzedrine*). To about 0.1 Gm. of propadrine hydrochloride in 5 cc. of water, add 1 cc. of diluted hydrochloric acid and 1 cc. of barium chloride solution: no turbidity develops (*sulfate*).

Dry about 0.3 Gm. of propadrine hydrochloride, accurately weighed, to constant weight at 100° C.: the loss in weight does not exceed 1 per cent. Incinerate about 0.3 Gm. of propadrine hydrochloride, accurately weighed: the residue does not exceed 0.3 per cent. Transfer about 0.2 Gm. of propadrine hydrochloride, accurately weighed, to a 500-cc. kjeldahl flask and determine the nitrogen content according to the method described in Methods of Analysis of the Association of Official Agricultural Chemists, fourth edition, page 23, art. 19: the amount of nitrogen is not less than 7.34 per cent, nor more than 7.52 per cent when calculated to the dried substance. Transfer about 0.2 Gm. of propadrine hydrochloride, accurately weighed, to a 400-

cc. beaker and determine the chloride content according to the method as described in Methods of Analysis, fourth edition, page 131, art. 35: the amount of chloride found corresponds to not less than 18.85 per cent, nor more than 19.95 per cent when calculated to the dried substance.

Propadrin Hydrochloride-Sharp & Dohme.—A brand of propadrine hydrochloride-N. N. R.

Manufactured by Sharp & Dohme, Inc., Philadelphia and Baltimore. U. S. patent 1,989,093 (Jan. 29, 1935; expires 1952). Propadrine is a U. S. registered trademark, but the firm disclaims any proprietary rights to the name.

Propadrin Hydrochloride Capsules, 3/8 grain (0.024 Gm.).

Propadrin Hydrochloride Nasal Jelly, 0.66%: Marketed in one-half ounce nasal tip collapsible tubes containing 0.66 per cent propadrine hydrochloride, with sodium chloride, menthol, thymol and oil of lavender in a water-soluble base; chlorbutanol 0.5 per cent is added as preservative.

Propadrin Hydrochloride Solution, 1%: An aqueous solution containing 1 per cent propadrine hydrochloride and 0.5 per cent chlorbutanol as preservative.

PERSONAL AND NEWS ITEMS.

Dr. E. G. Eberle, Editor of the JOURNAL, has been unwell recently, and has been at the Emergency Hospital in Washington for observation and treatment. He is making good progress and expects to leave the hospital at an early date.

Charles H. Schaefer was elected and installed regent of the Pittsburgh Graduate Chapter of Kappa Psi Pharmaceutical fraternity at the meeting on Thursday, October 21st. Other officers are John M. Wyble, *Vice-Regent;* W. F. Heidenreich, *Treasurer;* R. H. Mierzwa, *Secretary;* F. J. Steele, *Historian;* and John A. Berger, *Chaplain.*

Prof. Dr. R. Wasicky writes: "I beg you to announce to the AMERICAN PHARMACEUTICAL ASSOCIATION my heartiest thanks for the great honor in electing me an Honorary Member of the ASSOCIATION. The acknowledgment of my modest works by your ASSOCIATION, esteemed in the whole world, makes me feel very proud of this great distinction." Dr. Wasicky was elected to honorary membership at the New York meeting.

Upon the recommendation of the Kentucky Pharmaceutical Association, Governor Chandler of that state has appointed Mr. Clarence B. Davis, Louisville, as a member of the State Board of Health and Mr. M. Alvin Vaughn, Bowling Green, as a member of the State Board of Pharmacy. It is encouraging to note the increasing number of pharmacists being appointed to the State Health Boards.

OBITUARY.

CHARLES HERBERT PACKARD.

C. Herbert Packard was born in Amherst, Mass., in 1863, and died in Boston on October 3, 1937. He was educated in the public schools of Boston and, later at Arms Academy, Shelburne Falls, Mass. In 1885 he purchased the drug store in which he had been employed for five preceding years, at 46 Maverick Square, East Boston; in 1900 Mr. Packard acquired another store at 7 Central Square, and conducted both of these establishments until a few years ago when the latter store was sold.

Mr. Packard graduated from the Massachusetts College of Pharmacy in 1892; was elected a trustee of the College in 1904; served as its president from 1909 until 1922 when he declined reëlection; and was awarded the honorary degree of Doctor of Pharmacy in 1930. He was an interested member of the Alumni Association and took an active part in the successful efforts to provide a splendid building and endowment fund for the College.

Association activities were given their full share of Mr. Packard's time and attention. He joined the Massachusetts Pharmaceutical Association in 1886, served as committeeman and as delegate to national conventions, as a trustee of its Permanent Fund, as vice-president, and as president in 1907–1908. Last June the Association awarded him a life membership. He was active in the Boston Retail Druggists Association since 1904 and was a member and treasurer of the Boston Druggists' Association (a dining club) since 1917.

Mr. Packard joined the AMERICAN PHARMACEUTICAL ASSOCIATION in 1906, became a Life Member in 1921, and was local secretary in 1911, third vice-president in 1912, second vice-president in 1914, and president in 1920. When the New England Branch was organized he became the first president and served for three years.

For sixteen years Mr. Packard served the Maverick Congregational Church as treasurer. He belonged to the Masonic and other fraternal orders and served at various times as trustee or director of two banks.

On October 27, 1920, Mr. Packard was married in Winthrop to Miss Elma Anabel Wyer, who survives him.

R. B. J. STANBURY.

Dr. R. B. J. Stanbury, secretary of the Canadian Pharmaceutical Association, and

editor of the *Canadian Pharmaceutical Journal*, since 1924, was born at Bayfield, Ontario, and attended school in Toronto. He was a graduate of Jarvis Collegiate and old Trinity Medical College.

Following his graduation in medicine he occupied positions with various pharmaceutical manufacturing firms, eventually being appointed to the position of manager of Druggists' Corporation of Canada Ltd. He severed this connection in 1924, when he was appointed secretary of the Canadian Pharmaceutical Association.

DR. R. B. J. STANBURY.

He was a member of St. Andrews Chapter, A. F. and A. M.

Those surviving are his widow, Fay Morgan, one son, Douglas, of New York, and daughter Freda of Toronto, a sister Mrs. Stelck of Edmonton, and a brother, Judge Stanbury of St. Catherines.

Dr. Stanbury was highly esteemed by all members of the drug trade in Canada, and will long be remembered for the valuable work he has done in promoting the welfare of the pharmacists in the Dominion.

HENRY K. MULFORD.

Henry Kendall Mulford, born in Bridgeton, N. J., October 10, 1866, died at his residence, Hamilton Court, 39th and Chestnut Streets, Philadelphia, after a few days' illness.

The Mulford family were early settlers in New Jersey. Mr. Mulford graduated from the South Jersey Institute in 1884. Upon graduating from the Philadelphia College of Pharmacy in 1877, he took the drug store of Remington and Sayre. He founded the H. K. Mulford Co., manufacturers of pharmaceuticals, which later under his personal direction established a department for the production of antitoxins and vaccines. Upon retiring from the H. K. Mulford Co., he established the Mulford Colloid Laboratories. Later he became Director of the Research and Biological Laboratories of The National Drug Company of Philadelphia, and Swiftwater, in which he was active at the time of his death.

He received the honorary degree of Master of Science from Lafayette College in 1918, and the Master of Pharmacy degree from the Philadelphia Colege of Pharmacy and Science in 1933.

Mr. Mulford was a life member of the AMERICAN PHARMACEUTICAL ASSOCIATION, and member of the American Pharmaceutical Manufacturers' Association, American Drug Manufacturers Association, American Chemical Society, Franklin Institute, The Union League, Philadelphia, and past-president of the New Jersey Society of Pennsylvania.

He is survived by his wife, Lillian Ware Mulford; a daughter, Mrs. H. H. Fehr, of Bryn Mawr; a son, H. K. Mulford, Jr., of St. Davids; and a brother, Lewis J. Mulford, of New York.

HENRY ARTHUR ESTABROOK.

Henry A. Estabrook was born in Ashby, Massachusetts, on April 22, 1850, and died in Fitchburg on July 12, 1937. He attended the Ashby schools and later the Appleton Academy in New Ipswich, N. H.

His apprenticeship was served in the Salem store of H. & J. Price and he stayed with this firm until 1881 when he purchased the Dirby Drug Store in Fitchburg, which he conducted for fifty years. The thorough training and experience he received before acquiring his own pharmacy was a matter of great pride to him.

Mr. Estabrook joined the AMERICAN PHARMACEUTICAL ASSOCIATION in 1886, became a life member in 1922, and belonged to other organizations. He was a member of the first State Board of Registration in Pharmacy and served from 1923 to 1926 as a member of the General Court of Massachusetts, during the

last six years of which he was chairman of the House Committee on Education.

In 1887 Mr. Estabrook joined the Massachusetts College of Pharmacy, serving as a trustee from 1908, and as auditor from 1911, and was the Commencement speaker in 1916 when the honorary degree of Doctor of Pharmacy was conferred on him in recognition of his long and valuable services to Pharmacy and to the College.

SOCIETIES AND COLLEGES.

RHO CHI.

The Rho Chi Society held its fourteenth annual convention in New York City on August 17th. Dean Robert C. Wilson from the University of Georgia was the speaker at the annual banquet immediately preceding the business session. The society made the first step toward a reserve fund that is expected to be of definite value to pharmacy. They appropriated from that district the sum of $1000 as the first deposit in what is to be called the Cumulative Research Fund of the Rho Chi Society. It is hoped that this fund will be increased from time to time by contributions from interested parties as well as from the funds of the society. Further information concerning this fund may be attained by writing the national secretary. The following officers were installed to serve a two-year term:

National Secretary: Loyd E. Harris, University of Oklahoma, Norman, Oklahoma; *National Treasurer:* Professor W. G. Crockett, Medical College of Virginia, Richmond, Virginia; *Members of the Executive Committee* are: Marvin J. Andrews, University of Maryland, and Dr. A. H. Uhl, University of Wisconsin.

Announcement is made of the installation of the Rho Chi Chapter by the University of Mississippi School of Pharmacy on May 27, 1937.

The annual meeting of the Vermont Pharmaceutical Association was held in Rutland on September 20, 1937. Hugh P. Bierne of Connecticut was the guest speaker, and the principal topics for general discussion were a state Fair Trade law and improvements in the Association's organization. The dues were raised to $5.00 per year, and the new officers are: J. W. Blakely, Montpelier, *President;* Mrs. Mabel Clifford, Bethel, *Vice-President;* F. W. Wheeler, Springfield, *Secretary-Treasurer.*

ASSOCIATION DE FABRICANTES DE MEDICINES DE PUERTO RICO.

The above named is a newly organized association of Puerto Rican medicine manufacturers. The officers of the association are: Alejandro J. Cabassa, *President;* F. I. Carreras, *First Vice-President,* Lodo; F. L. Anselmi, *Second Vice-President;* Rolando Anglade, *Secretary;* and Francisco Sein, *Treasurer.* The directors are Dr. A. Giol Texidor, Lodo; Ishmael Moscoso, Lodo; Manuel Marin, Dr. Emilio Cumpiano and E. Bonano.

MANUFACTURERS OF PERFUMES AND MEDICINES, MEXICO.

Union Nacional de Fabricantes de Perfumeria y Medicines.—*President,* L. G. Aguilar, General Manager, H. E. Gerber & Cia., Venustiano Carraza No. 26, Mexico, D. F.; *First Vice-President,* Guillermo Garcia Colin, Director, Laboratorio Quimico Central, S. A., Guerrero 74; *Second Vice-President,* Oscar Villafante, General Manager, Picot Lebs., Inc., Regina 13; *Treasurer,* Guillermo Beick, Beick, Felix & Cia., Madero 39; *Secretary,* Manuel Leon Ortega, Manager, Hamburgo 218.

Members of the Board of Directors: Antonio de P. Giraud, Manager Cia. Medicinal La Campana, Tolsa 8; Paul Waltz, Manager, Waltz & Cia., Balderas 132; Herman Stoldt, Palma, No. 35; Eugenio Pinson, of Pinson Hermanos, Ramon Guzman 86; Elias Pardo, of Llano & Cia., Plaza de la Republica 40; Max Abbat, Lucerna 47; Jose Pomar Ruiz, Laboratories Higia, Av. Chapultepec 449; George Pfordte, Merck-Mexico, S. A., Versalles 15.

M. P. Lebeau, professor of pharmaceutical chemistry in the University of Paris, has been elected a member of the Academy of Sciences, Institute of France, to take the place of the late M. H. Le Chatelier.

NATIONAL CANCER INSTITUTE.

Senate Bill No. 2067 provides for fostering and aiding in coördinating research relating to cancer, to establish the National Cancer Institute.

Reference was made to this important measure in the April JOURNAL 1937, page 284; its purposes, etc. The bill came up for consideration and was passed.

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